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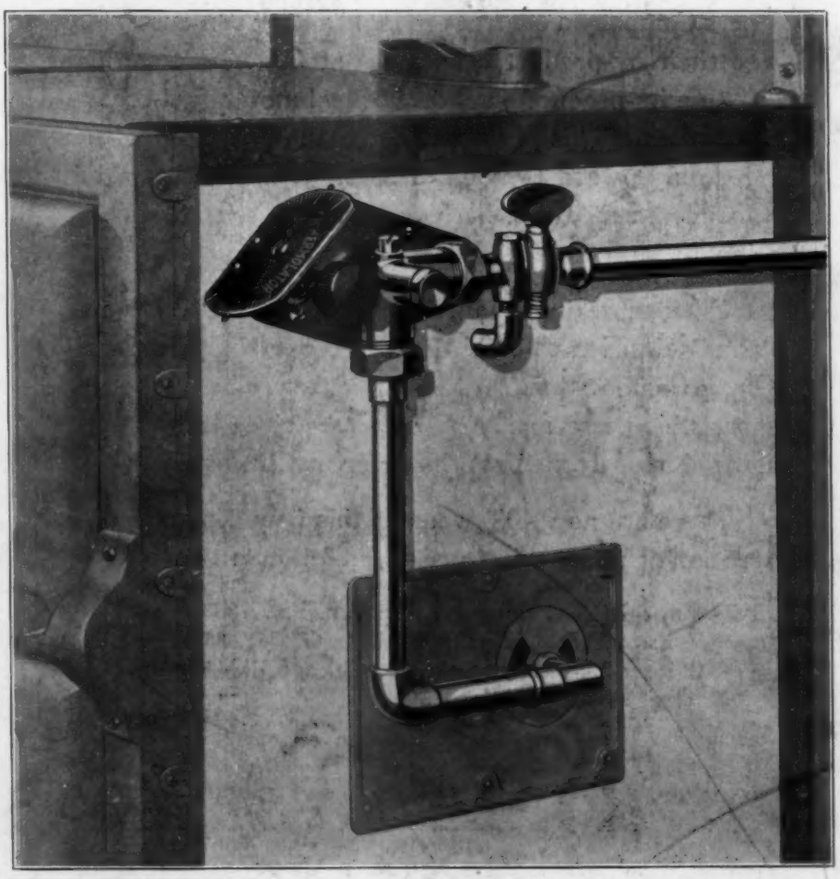

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The By-Product Coke Industry Moves Forward

The Carnegie Steel Company has awarded The Koppers Company a contract to build a 366 oven extension to their by-product coke plant at Clairton, together with a by-product plant and benzol motor fuel recovery plant. This is important as an indication of the general upward trend of business and the continued abandonment of the beehive oven as a source of coke supply.

Even more important is the Carnegie Steel Company's decision to build the New Type Koppers Company Combination Oven, a logical sequence of the remarkable performance of this oven since it was first placed in operation less than nine months ago.

There are now 408 ovens of this new design in operation or under construction, as follows:

Carnegie Steel Company, Clairton, Pa....366 ovens
Weirton Steel Company, Weirton, W. Va. 37 ovens
Chicago By-product Coke Co., Chicago, Ill. 5 ovens

Total .....408 ovens

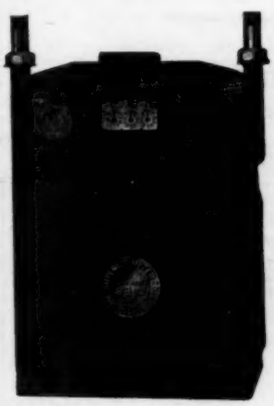
The KOPPERS COMPANY

Designers and Builders of
By-Product Coke & Gas Ovens
PITTSBURGH, PA.

SUPERIOR

Unlucky Birds

Quality ***Accuracy***



THERE are a few gas men who don't know about the Superior Meter—

Unlucky Birds!

Don't rub it in to them, you fellows who have them in service, by telling them what a fine meter it is. Offer a little sympathy instead.

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Booth 244

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METERS

American Gas Journal

SIXTY-THIRD YEAR

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Vol. 117, No. 17 NEW YORK, OCTOBER 21, 1922 Whole No. 3372

Comparative Methods of Heating Gas Holders

Denver Expert Outlines Advantages and Drawbacks of Three Systems

By GEORGE WEHRLE, Superintendent Gas Department, Denver Gas & Electric Light Company

During the winter of 1921-22 an opportunity was afforded the Denver Gas & Electric Light Company to compare simultaneously three different methods of heating gas holders, as follows:

Station No. 1—Using gas coke as fuel for generating steam.
Station No. 2—Using gas as fuel for generating steam.
Station No. 3—By circulation of the water in the holder tank and cups supplemented by gas steam.

The holders were of the same size and type of construction and were all used as district holders. They were three lift holders in steel tanks aboveground and their capacity was 500,000 cu. ft. each. The exposure was about the same in each case.

In this climate it is necessary to provide means of keeping the water in gas holders from freezing during five months of the year and during the winter just passed temperatures were as follows:

	High Deg. Fahr.	Low Deg. Fahr.	Mean Deg. Fahr.
November	72	13	43.7
December	72	1	35.4
January	61	—10	27.8
February	63	— 1	31.4
March	68	— 7	40.3

This compares with the following mean temperatures recorded by the United States Weather Bureau for the period from 1872 to 1921 inclusive:

November	39.8 deg. Fahr.
December	32.0 deg. Fahr.
January	30.9 deg. Fahr.
February	32.9 deg. Fahr.
March	40.4 deg. Fahr.

Recording thermometers are provided at the holder stations and hourly readings taken on the gas meters supplying the gas steam generators. Out of the 3,624 hours contained in the five winter months, steam was used at station No. 2, 1,081 hours and at station No. 3, 294 hours, the former being 30 per cent of the possible time and the latter 8 per cent. During the 1,081 hours when temperatures were below freezing, at station No. 3 steam was used in conjunction with the circulation of the water only 27 per cent of the time, while for 73 per cent of the time the holder was prevented from freezing by circulation of the water only.

The amounts of fuel used at the three holders, designating them as stations 1, 2 and 3, were as follows:

No. 1	94 tons of coke
No. 2	1,367,000 cu. ft. of gas
No. 3	426,500 cu. ft. of gas and 7,196 kw. hr. electricity

The B.t.u. input to the water in the holders theoretically calculated as being 100 per cent of that contained in the fuel used was as follows:

No. 1	2,444,000,000 B.t.u.
No. 2	751,850,000 B.t.u.
No. 3	234,575,000 B.t.u.

The heating energy of the electric current used at station No. 3 is not considered because this energy did not contribute heat to the water. It is seen that over 200 per cent more heating energy was consumed at station No. 1 than at station No. 2. This was caused primarily by the greater flexibility of the gas steam generators, although better boiler efficiency was also obtained.

Ratio of Fuel Costs

At Station No. 1 the coke-fired boiler was under fire during practically the entire heating season, while the other stations operated their heating or circulating equipment only when temperatures were below the freezing point. Due to the time required to get the coke-fired boiler under steam and rapidity with which temperatures sometimes change in this climate, it is unsafe to let this boiler down, although it is often kept under banked fire for a portion of the day. The ratio of fuel costs at the three stations was 7:6:2.7, with the coke figured at residual credit price plus hauling, and the gas and electric current at production and distribution cost. The cost of heating Holder No. 3 was therefore 45 per cent of the cost of No. 2 and 39 per cent of the cost of No. 1, representing a saving in expense of several hundreds of dollars and practically wiping out the investment cost in one season.

A little centrifugal pump belted to a 10-h.p. motor was used to circulate the water in the holder tank and cups. This pump has a 2-in. suction and 1½-in. discharge. The suction pipe was increased to 3 in. from the pump and was carried over the platform and extended about 4 ft. below the level of the water in the tank. Connections were made from the pump to the

2-in. pipe supplying steam to the holder, from which the syphons were removed and jets installed in their place pointing in a circular direction around the tanks and cups. Three ⅛-in. jets were used in the tank, five ⅛-in. in the first cup and five ¼-in. in the second cup. The gauge pressure at the outlet of the pump showed 50 lb. pressure when the holder was full, and the velocity of the water in the top cup was sufficient at all times to keep ice from forming in this cup except for a thin feather midway between jets on one or two occasions when the temperature was below zero. Steam connection from the boiler to the suction side of the pump was made at the holder platform, and during extremely cold weather steam was injected into the water before it passed to the pump.

Based on Two Theories

From this description it is seen that water was drawn from the holder tank and discharged into the cups, from which it overflowed on the inside of the holder back to the tank. The experiment was conducted on the strength of our belief in two theories: first, that water traveling at high velocity, as in a rapidly flowing stream, resisted extremely low temperatures before freezing; and, second, that the water in the tank contained millions of heat units that could be utilized if carried to a point where they would be given up. We realized that the flow of water in the cups must be at a rate greater than the capacity of the temperature to extract the heat therefrom to the freezing point, and our experiment was carried on with some doubt as to what would happen when the temperature went below zero or when we would have exhausted all of the heat contained in the 1,500,000 gal. of water. We found during the past winter, which may be considered of normal temperature for this climate, that our doubts were groundless, probably due in a measure to heat given up to the water from the gas entering the holder and to the energy stored in the water during the warmer periods of the winter days. We probably used more steam at Station No. 3 than was absolutely necessary to actually keep the holder from freezing, since we were inexperienced in this method and did not desire to take any chance. Our final experience indicated that steam was not needed until the temperature became 15 deg. Fahr. Between 15 and 32 deg. freezing was prevented by circulation only.

Preparations are being made to equip the three holder stations permanently with circulating pumps for use before the coming winter. The pumps will be driven by the motors through link-belt silent chain drive. At Station No. 1 the coke-fired boiler will be used as a heater, all water being circulated through it and heat applied when necessary by the use of a coke fire. We expect by this means to save one-half of the coke ordinarily used, which will amount to some 550 tons. Equipment at Stations 2 and 3 will be identical.

In future holders we expect to install a 4-in. suction pipe through the bottom of the tank extending along the side of the inlet pipe to a point near the top of the water, thereby giving us the advantage of warmer water than can be obtained at the outside of the tank.

Gas Securities as an Investment; What the Public Thinks of Them

Bond Salesmen Encounter Several Misconceptions but These Can Easily Be Dissipated

By GUY R. KINSLEY, Cyrus Peirce & Co.

There are many glaring fallacies concerning the gas business which should be scotched, and against which during the past year gasmen of the country have been doing effective work. Such efforts were showing results and the American public was slowly accepting the truth and discarding the fiction. A few weeks ago, a national financial service restated the old fallacy as follows:

"Gas companies have probably seen their best days. Certainly, when a cheap method of heating by electricity has been discovered, gas companies for the most part will go out of existence."

More than a year ago, a California investment banking house discovered that some of its clients objected to a long term gas bond for practically the same mistaken reason. This institution saw the need of facts to counteract this belief and in a booklet prepared by it appeared this statement:

"A very small part of the public unacquainted with the real growing strength of the gas business has been so impressed with the progress that has been made in developing electric power, and has been so charmed by its romance, that they believe electricity may displace gas. They go so far as to think that in fifty or one hundred years gas may have become a thing of the past and every necessary artificial function will be performed by the magic of an electric button. This magic may be supplied by the electric button, but a greater and greater share of the work which the button starts will be done by gas long after skeptics have been converted or become extinct."

There is no need to discuss with men of the gas business the axioms that the field for the expansion of electricity is power and the field for the expansion of gas is heat. Engineers can and have demonstrated the saving of gas over electricity for heat; the economy in installation of its equipment and the many other reasons why gas and electricity are not competitors but allies.

To Guage Public Interest

One of the quickest ways to guage the public's

*Paper read at recent convention of the Pacific Coast Gas Association.

estimate of anything is to try to sell it. In most cases, however, you are selling stock in joint gas and electric businesses and many investors consider the electric business the mainstay and potentiality that will protect the investment against the slow decease of gas. In such cases, you do not receive the reaction that comes from offering a gas security.

The public has long felt that gas detracts from the stability of joint electric and gas company business; that gas pulls a diminishing share of the load. Endless refutation of this exists. For example, the Pacific Gas & Electric Company, on May 31, 1922, had 301,417 gas consumers as compared to 291,702 in the electric department. The gain over 1921 was 3,660 more in the gas department than in the electric. Gas sales increased $1,408,360 in 1921 over 1920.

But almost without exception, the companies which are joint gas and electric do most of their boasting about the electric end of the business. They make speeches about electricity; do nine-tenths of their advertising to further the electric business and slight gas as an ugly duckling. There is small wonder that the public is willing to believe most any disparagement of gas when it is so poorly fortified in the public mind with facts and favorable propaganda. Everyone knows of the hydro-electric development planned in California and the money that will be spent in the next ten years to keep pace with the State's growth; but does anyone know how much will be spent for the service of gas?

To Educate the Public

However well the men in the business may understand the stability of the gas business, or how thoroughly the investment banker may know it, there remains great need for educating the public. As an illustration of this fact, take the case of two strong bonds—one a bond of a gas company and the other of a hydro-electric company. We will select two bonds as nearly comparable as possible. Each a first mortgage with a 6 per cent coupon, the same maturity, the same callable features; both are favored by prosperity; each has strong earnings and equally good management. They should maintain practically an equal price in the market.

However, a chart made of the selling prices during the last two years shows that quite the contrary is true.

The latter part of Oct., 1920, found the gas bond a half-point below the hydro-electric bond. At the end of Nov., 1920, for a few days, they were practically together; but the hydro-electric bond immediately started to rise and in December was a point higher; in January was four points higher; in February three points higher; in March three-fourths of a point higher, and in April, May and June, the gas bond began to appreciate until on the first of July, 1921, it almost reached the level of the hydro-electric bond. But from this date until the end of July, 1922, there was a margin of from more than one-half point to as high as four points difference in the prices of these two bonds—with continuous advantage to the hydro-electric bond.

During last August, the hydro-electric bond rose from a little more than 98 to 101; the gas bond remained at a little less than 99—a difference of two points, or $10 per $1,000 bond. Within the last few days the price of the gas bond has increased to 100¼-101, while the electric bond is at 102-102½. Of course, the gas bond has been a bargain when compared with the price of the hydro-electric bond, and in time the price of the gas bond will reach the present level of the hydro-electric bond, but when it does the hydro-electric bond may again be higher. In other words, the difference in popularity of these two issues may be accounted for by the popular belief that hydro-electricty has a greater future than gas and may eventually dsplace gas.

Bonds Are Underestimated

I do not mean to imply that gas bonds are in disfavor with investors; but that they do not enjoy the favor to which they are entitled. They do not rank as high as they should in the public utility group. Public Utility bonds (including gas bonds, of course) now provide (with the exception of Liberty bonds) the most popular form of investment among investors because investors have come to realize that public utilities are least affected by changing business conditions; they are regulated monopolies; they serve necessities; they have no heavy inventories to write off; they operate on a cash basis, collections are easily handled, and their rates are fixed. The public utility in my opinion is fast usurping the place in popular favor formerly occupied by railroad securities.

The investor who buys public utility securities is attracted by security of principal and assurance of return. He is not a speculator. While neither the public utility company nor the regulating body can give any absolute guarantee, either as to security or return, the investor in public utility securities can have greater assurance than in any other investment short of civic obligations.

When the Great War started, the increase in commodity prices and wages added so greatly to the operating expenses that many utilities were threatened with losses. Regulatory commissions quickly realized the need of maintaining the utility industry in the best possible condition. Rate advances were granted generally. No class of enterprise came through the war more uniformly prosperous. In practically every State where regulation of utilities is in effect the thinking public recognizes its virtue.

Receivership Risks Analyzed

In a recent compilation of receivership risks, it was found that the risk of receivership in industrial concerns is $2.07 per year per $100 of securities outstanding; with railroads it is $1.84 per $100 of securities outstanding, and with public utilities (excluding street railways) it is only 37 cents, which is only 5 cents above that of national banks.

Some investors look upon the reduction in the price of gas as endangering the earning power of the gas companies. It is well to remember in this connection that the cost of gas to the consumer has declined steadily during the last thirty-five years. In 1885, in the United States, the average price of gas was $2.01 per thousand cubic feet; in 1896, $1.53; in 1907, $1.09; and to-day, in California, 79 cents—which is practically down to the pre-war level. It is worthy of note that in the ten years from 1900 to 1910, when the price de-

creased 32 per cent, the actual volume of sales increased 120 per cent.

There is one outstanding reason why gas companies should be interested in the viewpoint of the investor toward their securities in addition to the obvious advantage of customer partnership.

When a gas company issues bonds, the amount is usually limited to 75 per cent of the cost of the improvements to be made. Accordingly, the other 25 per cent, and, in addition, the amount of discount the company must pay to market them, must be made up somewhere. The most approved manner of making up this amount has been from the sale of preferred stock.

To Win Public's Confidence

It is more difficult to induce an investor to become a partner in any enterprise through the sale of stock than to sell him bonds secured by a mortgage on specific property and offer him the position of a creditor. The interest return on the stock must be higher to attract the investor, but it is to the company's interest to see that it is marketed at the highest possible price. It is to the interest of the gas companies to gain the confidence of the public by making known their plans. Let the public have faith in the management. This is important.

When a man begins to discuss an investment stock, the primary consideration is "management." It is directly to the interests of the companies to appreciate the attitude of the investor and to emphasize the question of management. The best way to let the public know gas company management is to give service; tell once in a while what has been and is to be done, and show adequate net earnings.

The investment banker knows the true value of gas bonds of good companies. He is aware that gas sales are keeping pace with the industrial growth and economic changes of the country. He is thoroughly convinced of the future of gas—but he alone cannot carry on the work of educating the investing public. The investment banker cannot sell gas securities on an equality with hydroelectric or gas and electric securities. It is simply that there is greater sales resistance, and this resistance comes of ignorance. The gas companies pay.

The general public, including a majority of investors, does not properly value the strength of gas companies and is prone to look with more favor on the electric or joint gas and electric company than on a company which produces and distributes gas alone.

The Investment Banker Knows

That part of the public represented by the investment banker and the well-informed investor realizes the strength of well-managed gas properties and the safety of their securities. The investment banker knows the place that gas occupies in industry and its possibilities; and he believes that the gasmen of to-day are fully awake to their responsibilities.

Gas companies have much to gain through education of the public. Their business cannot continue to effect needed expansion without additional capital—and this must come from the public. Their capital requirements are large. The educational work, if properly done, will be reflected in the price that the gas companies will receive for their securities. The gas companies, therefore, must do this work of education.

Short, intermittent campaigns will not avail. There must be a long, steady effort, because the feeling now in the minds of many investors cannot be overthrown quickly. Why not be proud of gas, tell of its virtues, its future; make it a favorite child and boast about it? Let us say that electricity as a competitor of gas for the *creation of heat* is a bugaboo of the hair-rope variety. If the gas companies keep eternally at it, pounding home their truths, the alarmists will have smaller and less responsive audiences; gas will be accepted at its true value and truth will prevail.

Gas company securities are entitled to a rating near the top of the public utilities list, because:

The uses and earning power of gas are increasing steadily;
Its price to the consumer throughout the United States has been decreasing for the past thirty-five years;
Its use is not endangered by competition;
Its service is regulated by the people;
Its supply is plentiful and the brains adapting it to the public use are equal to those serving any other line of business.

Great is its past—but the real achievements of gas are still in the future.

Screen Sizing of Coal and Minerals

A study is being made by the Bureau of Mines at Urbana, Ill., of the equipment and methods used in screen sizing of coal and coke, metalliferous ores, stone gravel, and various mineral products. The design, operation and advantages of various types of screening machines used in the mineral industries and the kind of service to which each type of machine is particularly suited are being studied. A publication on this subject is being prepared.

Spontaneous Combustion of Coal

At the Pittsburgh, Pa., experiment station of the United States Bureau of Mines, J. D. Davis, fuel chemist, and J. F. Byrne, research fellow, Carnegie Institute of Technology, have investigated the relative tendency of Pennsylvania coals to ignite spontaneously. The research consisted largely in the development of methods for the determination of the comparative sensitivity of coals to oxygen. A study was made of the comparative sensitivity of coal constituents to oxidation in co-operation with Dr. H. Thiessen, research chemist, the coal constituents being separated by the aid of a microscope.

Heat of Distillation of Coal

J. D. Davis, fuels chemist, and Palmer B. Place, junior analytical chemist, of the Pittsburgh, Pa., experimental station of the Bureau of Mines, have developed a precise method for the determination of the heat of reaction of coals during carbonization. Typical coals have been studied for reaction heats over ranges of temperature in which primary decomposition products are formed. The investigation is now being extended over higher temperature ranges where, according to theory, reaction heats should be largely endothermic.

Value of Good-Will to a Public Utility*

Twofold Problem Concerned with Relations (1) to Customers and (2) to Employees

By I. H. RICE, President Merchants and Manufacturers Association, Los Angeles, Cal.

It is very difficult to approach such a one-sided subject as good-will in business without the danger of appearing very elemental in the discussion or resolving into the tone of a preachment, yet among the multitudinous details of public service this may be one subject that will permit of an extra emphasis, until the acceptance of its value becomes a habit. The dictionary definition of good-will very simply presents the comprehension of the word from three viewpoints:

1. A desire for the prosperity and well-being of others.
2. The established popularity of a business house, tending to maintain its custom.
3. The value that a business has over and above the money invested.

In an ordinary commercial business the value of good-will is based on the two latter angles—its established popularity as a going concern, and the actual mathematically determined amount that may be credited to good-will as the percentage of profits increase through the reduction of overhead expense that is found in the most popular establishments.

Cutting Cost of Selling

The same is true in manufacturing and jobbing, when strongly established markets and appreciation of business methods and service make the lessened cost of selling a measurable quantity.

All these definite elements that go into the building of good-will are the real incentives to the progressive business man, and provide the joy of doing business, but since the advent of Government in business, with the resultant regulations of rates and profits, the inventory value of good-will to the public utility has been annihilated, and the only asset remaining is the physical value of the property.

So, as far as the purpose of discussing the value of good-will to the public utility is concerned, we have exhausted the definition of the word from all angles save the first—"a desire for the well-being and prosperity of others." In other words, our consideration of the subject cannot be quite as much from the balance sheet viewpoint as would be the case in a commercial business.

I would place as the first value of good-will the point that it is the greatest reward for doing business on the basis of the Golden Rule. More than ever in history are men accepting the value of physical and mental fitness as a business asset, and it is safe to assert that aside from financial success there is nothing in business life more uplifting, nothing that puts more joy into existence—from the president to the janitor—than to be in the service of a corporation that has the good-will of the public. There is a different appreciation of life in the man who can proudly say, "I am with the Popular Gas Company." Contrast his feelings with those of the man whose friend says, "I should think you would quit your job with that damned gas company."

Industrial Relations Problem

There is no subject in economics that is raising more attention and study to-day than industrial relations, which is principally a problem of the feelings of men through a proper understanding. By the higher development of the details of sound industrial relations will come the understanding and practice which will result in a minimizing of labor turnover and a loyalty and co-operation that will make the duties of all more pleasant, healthful and profitable.

The details of gaining good-will are, in the case of public utilities, as varied and as interesting as the imagination of the management will reach.

With so great a number of persons in contact with the public there are ways innumerable to cultivate the good opinion of the consumer to the point where he will absolutely glow with a feeling of well-wishing to the company.

First, of course, is in the matter of politeness and personal gentility. And in this there is a difference between the cold politeness and frozen face of the banker and the genial courtesy of the successful salesman. It might at first thought seem a far cry to expect the "trouble shooter," collector or meter reader of a gas company to regard his position in the slightest degree akin to that of the salesman, but it can be done quite easily, and with an understanding of his responsibility for the good-will of the company he will develop a new loyalty and appreciation of his position that will go far toward eliminating the humdrum of mechanical routine.

Personal Note Efficacious

Nearly any grouchy consumer can be turned into a good-will asset with a pleasant and intelligent explanation. The most "hard boiled" householder is susceptible to a cheery "How do you like the service now?" or "Are your stove and heater working all right?" It is the personal interest in the satisfaction of the consumer that is sure to bring, at least subconsciously, his good-will toward the company, and make a potential friend the next time a gas holder location or an unavoidable low pressure period brings the company under the guns of the anti-corporation propagandists.

It must be admitted that the life of the men who contact directly with the consuming public is not a bed of roses, but it has been my observation that the garrulous, unreasoning attitude of the individual in many cases is only a reflection of the imperious, unsympathetic position of some employee who may

*Paper read at recent convention of the Pacific Coast Gas Association.

have been doing his full duty, with the exception of exercising the patience and intelligence required to furnish the consumer with a pleasant explanation of the situation.

The knowledge that the consumer is in a position of helplessness works to the disadvantage of good-will on both sides. The average householder becomes irritated and even abusive in the face of difficulties or inconveniences at the hands of utility monopoly, and it is only human nature for the company's representative to resent the "cussing" and "bawling out," in the consciousness that he can make the kicker pay the fiddler in many ways. It is a similar situation to that when business conditions are described as a "sellers' market," when the heads of commercial enterprises must be on their toes to maintain their good-will asset.

Value of Education

Altogether this angle of building good-will is a psychological one, not subject to rules or regulations, but possible of astonishing development through painstaking education. I believe a manual could be compiled, if such does not already exist, of the common troubles in company and public relations, that the employee may to an extent become cultured in his words and manners.

I am assuming in all this that the management of practically every public utility of to-day recognizes the absolute business necessity of giving the best service and treatment to the public that is possible, and on this point I am constrained to relate an incident that occurred in my own experience within a few years.

It happened that in the same month in my business there was a water bill some five times normal, and an electric power bill about 50 per cent over the average amount. I phoned the city water department to ask for an investigation of the matter and was told very abruptly by a civil service employee that their office and meters made no mistakes and that I had better pay the bill promptly or the water would be shut off.

I was then in a frame of mind to get hostile very easily when I phoned the power company, but was so pleasantly told that the matter would have immediate attention that the impudence of the city employee was almost forgotten.

The company sent two men to the factory next day, and in course of a week I was handed a three-page report of tests of motors, meters and machinery that plainly pointed out the difficulty and made it easy to stop the leaks.

I have since bought stock in that corporation, and to efface the memory of the liberal and efficient they will have to use me pretty tough in the future service

How to "Get There"

We must not forget that the ill-will of the general public toward utility corporations is traditional, and we must also admit that a large part of it was justifiable in the old-time attitude of many railroads and other monopolies. So it follows that much of the good-will building of to-day must begin with the handicap of a foundation of quicksands of distrust and progress hindered by the demagogues, political and otherwise.

It is strange that the strongest and most permanent method of establishing corporate good-will has only been siezed upon generally within a few years. I refer to the comprehensive drives being made by a number of large corporations to make their consumers participating stockholders. Of course, the shares in nearly all utility companies have been available in the market to all who might buy, and a considerable distribution of stock has thus been effected, but to contemplate the recent achievement of one certain corporation in taking nearly 50,000 individuals from a specific territory into partnership is going a long ways toward the day when public opinion will at least be open minded, and the continual fight of the utilities for a square deal at the hands of legislative bodies will be a matter of unpleasant history.

As a final comment, I am of the conviction that a great majority of the American public is rather naturally inclined toward a disposition of good-will and fair play, a state of mind that changes reluctantly, and I further believe that the education of the individual to the rights of invested capital can only be accomplished upon the receptive foundation of good-will.

Fuel Economy Investigations

At the request of the United States Veterans' Bureau, the Bureau of Mines has undertaken an investigation of the fuel requirements of the different hospitals of the Veterans' Bureau. A fuel engineer from the Pittsburgh office has been detailed to make the survey, which covers two main lines: First, the present fuel-using practice of these institution, and, second, the sources and kinds of fuel now used by the hospitals in order to suggest economy through the use of kinds of coal that can be obtained at lower cost, with equal efficiency, and from mines near by for the sake of lower freight rates.

An examination of the entire plant and tests of the boilers of the Bureau of Printing and Engraving in Washington have been completed.

Coal-Cleaning Methods

Problems that develop in the mechanical preparation of coal in the Central and Eastern coal fields are being investigated at the Central experiment station of the Bureau of Mines at Urbana, Ill., in co-operation with the University of Illinois and the Illinois Geological Survey. Work on coal-cleaning methods is being continued, as the problem of cleaning coal is receiving more attention in the bituminous coal mining industry. A study has been made of the methods of examining a coal as it exists in the raw state, in order to determine the practicability of improving it by coal-cleaning processes. Results are to be prepared for publication.

Desulphurization of Coke

A study of the action of steam on coke, with regard to the reduction in sulphur content of the coke, is being made at the Pittsburgh experiment station of the Bureau of Mines by A. R. Powell, physical organic chemist, and S. H. Thompson, research fellow of the Carnegie Institute of Technology.

Problems of Load Variation in Gas Supply*

How to Provide Economically Not Only for Daily Peak but for Seasonal Highs and Lows

By ARTHUR F. BRIDGE

In this paper I have attempted to discuss the effect of load variation upon a typical gas utility, giving consideration both to the economic and the physical aspects of the problem. The seasonal variation in sendout of any gas company is primarily due to the heating load, which is present to a greater or less extent, dependent on climate, cost of gas per heat unit, rate policy of the company, etc.

In southern California all conditions have been favorable to the development of a relatively heavy heating load—mild climate, which permits the use of gas for all heating without prohibitive cost; low rate per heat unit, due to natural gas; steeply blocked rate schedules, which promote increased usage, and, in many instances, active solicitation of heating business by the utility. The result has been a progressive decline in annual load factor for those companies supplying domestic business exclusively.

In this territory we are rapidly approaching, or have already reached, an economically unbalanced condition of providing service facilities, involving large expenditures for capital and operation, and which are usefully employed but a few days per year.

Typical of Natural Gas

While this condition has become acute in southern California in recent years, it is typical of natural gas service throughout the country and, of course, affects in a minor degree the service of artificial gas. The matter should therefore be of more than local interest.

The following chart and table show the distortion of the annual load curve resulting from the growth in heating business. The operations of the Los Angeles Gas & Electric Corporation have been used to illustrate these conditions, because the data is complete, and the effect of the domestic heating business on the load curve is not screened by low rate industrial business, as is the case with Southern California Gas Company and Southern Counties Gas Company:

TABLE No. 1

Number of Days in Year, Jan. 31, 1921, to Jan. 31, 1922, When Sendout Equaled or Exceeded Given Amounts

Los Angeles Gas & Electric Corporation

Sendout Thousand Cubic Feet	Number of Days	Number of Days Sendout Equaled or Exceeded Figures in Column 1
85,000* or over.....	1	1
65,000 to 70,000.....	4	5
60,000 to 65,000.....	2	7
55,000 to 60,000.....	3	10
50,000 to 55,000.....	13	23
45,000 to 50,000.....	6	29
40,000 to 45,000.....	24	53
35,000 to 40,000.....	37	90
30,000 to 35,000.....	44	134
25,000 to 30,000.....	38	172
20,000 to 25,000.....	48	220
15,000 to 20,000.....	140	360
10,000 to 15,000.....	5	365

*Demand estimated 85,000 thousand; actual 70,646 thousand.

Chart No. 1 gives a comparison of annual load curves for three gas utilities, typifying as many widely variant conditions as follows:

L. A. G. & E.—Mixed gas, exclusively domestic, rate per million B.t.u., 94 cents; large heating load.

P. G. & E.—San Francisco district—artificial gas, exclusively domestic, rate per million B.t.u., $1.67; relatively light heating load.

Southern Counties Gas Company—Natural gas, predominantly industrial, rate per million B.t.u., 80 cents; large heating load.

Southern Counties Gas Company receives all of its gas wells that are producers of both oil and gas, the gas production being incidental to that of the oil. The operating problem therefore resolves itself to successfully maintaining the following equation:

Well production minus producers' requirements equals consumers' demands.

The first two terms of this equation are independent variables not subject to control by the utility, and all three terms vary widely. The answer to this particular problem is the off-peak industrial consumer.

Table 1 illustrates the economic disadvantages resulting from the ever growing heating demands. The conditions shown are merely typified by the data shown for the L. A. G. & E. system; they are paralleled in the cases of Southern California Gas Company and Southern Counties Gas Company.

Analysis of Tabulation

Analysis of this tabulation shows that in order to meet all demands of its consumers during the winter 1921-1922 it would have been necessary for this utility to provide generating equipment of 65,000,000 cu. ft. per day capacity (after allowing for natural gas available for mixing), assuming adequate storage available; and compressor, transmission and distribution facilities of approximately 140,000,000 ft. per day capacity. Of this equipment 17,000,000 cu. ft. of

*From paper read before Pacific Gas Association, September, 1922.

daily generating capacity is used but one day in the year and 30,000,000 cu. ft. only ten days. Correspondingly, some 45,000,000 of compressor and main capacity is used only ten days during the year. In effect this means that at least one-fourth the entire invested capital is provided to meet demands of such infrequency that it is idle 97 per cent of the time. Based on peak hour demand the annual load factor is only 22 per cent.

This disproportionate increase in peaks, combined with rapid growth of the communities served, has increased the capital of the local gas companies from $37,000,000 to $62,000,000 in the two years ending June 30, 1922, an increase of 67 per cent. During the same period the investment per consumer has risen from $136 to $176, while the added investment per new consumer averaged $310.

How shall this situation be met? Several alternatives are available, which may be classified as follows:

1. Provide facilities sufficient only to handle average heavy winter demands, thus creating partial shortages on extreme peak days.
2. Regulate consumers' demands, either directly, or indirectly by the form of rate schedule.
3. Meet all of consumers' requirements, but design betterments to systems which will give maximum flexibility and economy in handling extreme demands.
4. Combination of 1 and 2, or 2 and 3 above.

The first scheme is abhorrent to most gasmen, and doubtless would create such a volume of complaint, especially if it were announced as a permanent policy, as to make its continuance impossible.

The second proposal may be effected in several ways, viz.:

(a) Discontinuance of service to certain classes of consumers during peak periods, in accordance with a pre-established priority schedule. These consumers, of course, must be equipped to use substitute fuels.

This method is now successfully employed with respect to relatively large industrial gas users, such as steam boiler plants, oil refineries and brickyards, who are prepared to convert to oil fuel at a few minutes' notice.

Weak Points of Method

In this way several hundred thousand feet per hour may be made available for domestic use by shutting off a few consumers. It is the author's opinion that it would not be feasible to extend this method to the larger heating consumers, such as hotels, apartments, business buildings, etc., even though they can conveniently use other fuels, unless their meters were locked off for the duration of the peak season. This becomes obvious when it is considered that to obtain a load reduction of any value, it would be necessary to shut off several hundred such consumers. Experience has shown that requests to the consumer to shut off gas are frequently enforcible only with the meterman's wrench and a padlock.

(b) Use of demand limiting devices.

This method has been employed with considerable success in several Kansas and Missouri cities where shortages of natural gas had become acute, due primarily to excessive heating demands. The author recently made a study of the results obtained under this system. The demand limiting device is used in conjunction with the familiar Doherty three-part rate, the consumer being required to contract a certain demand for a year's period. The device is a constant pressure, constant volume regulator, which costs about $7 installed, and which operates to limit consumption to a predetermined rate. Typical results obtained under this system are a reduction of 40 per cent in peak hour demand without reducing total consumption. The Public Utilities Commission of Kansas has recently ordered the installation of demand limiting regulators and the application of three-part rates in some twenty-five cities.

One of the best features of this plan is that the consumer who creates a heavy heating demand accompanied by a poor annual load factor—for instance, the consumer with a large furnace—pays his proper share of the investment costs resulting from his demand. This is in marked contrast with the form of rate now effective here, which, due to its steep blocking, actually penalizes the high load factor consumer and, conversely, favors the consumer who uses gas only during the heating season.

Installation of a demand charge accomplishes two things: It reduces peak demands and furnishes revenue necessary to provide capacity to meet peaks, thus relieving of this extra cost, consumers who receive no benefit from such expenditures.

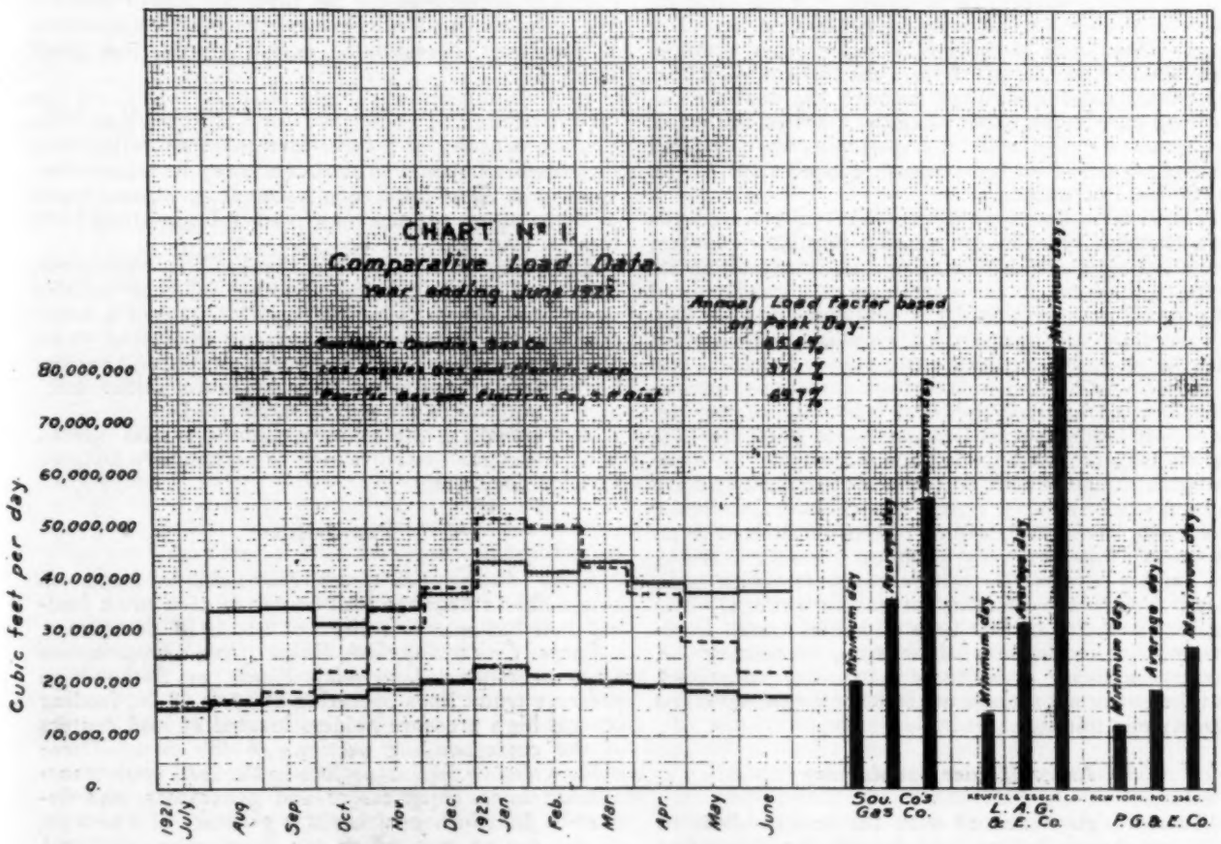
Consumers Entirely Satisfied

Managers of Kansas and Missouri distributing companies operating under the three-part rate state that their consumers are entirely satisfied with this form of schedule and well pleased with the improved service which has resulted from its operation.

(c) Adoption of the type of schedule in which the rate increases with monthly consumption.

This has been extensively used in Eastern communities with good effect in reducing peaks. From a rate standpoint, however, it is inequitable, as the large consumer is penalized, regardless of his load factor, or the diversity of his demand with respect to system heating peak.

As to the third proposal, in designing a gas system to most economically handle high and infrequent peaks, it is of prime importance to minimize investment and its accompanying fixed charges. This resolves itself into the problem of improving the peak day load factor of as many elements of the system as possible. The answer is distributed storage. The peak hour is approximately twice the average hour; hence with perfectly distributed storage the daily capacity of the entire system would be doubled. As heretofore shown in chart No. 2, storage equivalent to about 24 per cent of the day's sendout will completely equalize the hourly load or, in other words, storage capacity of, say, 27,000,000 cu. ft. (allow-



ing for the diversity between demands of various sections of the territory supplied), will, if completely distributed, take the place of generator, compressor, transmission and distribution facilities of 100,000,000 cu. ft. daily capacity. The tremendous economies obtainable, in approximating as far as practicable the condition of completely distributed storage, are manifest. To quote briefly along the same lines from the report of the 1921 committee of the American Gas Association on increasing distribution capacities:

"If ideal distribution of gas could be attained there would be a miniature gas holder on every customer's premises, which would be of such size as to supply his need for gas during the demand periods, and in which the supply would be replenished when his demand ceased. The load factor on mains and services would be 100 per cent, since an equal rate of flow into the numerous holders would be going on at all times. The size of mains and services would be very small, since they would not need to be proportioned to meet any peak demands."

One System Supplies Forty-four Towns

The natural gas properties of Southern Counties Gas Company consist of isolated distribution systems supplying forty-four towns and cities, varying in population from 500 to 75,000, which are fed from an interconnected transmission network operated at pressures from 100 to 300 lb.

A peak day load of approximately 50,000,000 cu. ft. is supplied with only 2,960,000 cu. ft. storage capacity, exclusive of line pack. As a result, with rapid growth in consumers, we have been forcibly confronted with the same problem as that of L. A. G. & E. Company heretofore described, namely, that of greatly enlarging our peak hour delivery capacity. This condition was naturally more acute in those districts where domestic gas is supplied almost exclusively, such as Pomona and Monrovia districts.

It is obvious that in the case of a city or district supplied from a long transmission line, terminal storage is of the greatest value as it approximately doubles the transmission capacity. Furthermore, we are supplied from sources the hourly delivery rate of which cannot be varied to meet our requirements. While realizing the advantages of storage, we were unable to utilize it, except in the largest communities, on account of the prohibitive cost of operating a compressor station in a small town. All of our distribution systems are either high pressure or low pressure mains without compression. This, of course, eliminates all operating expenses. A holder of this type was installed at Azusa in 1921 and has been in continuous operation since, without attendance, affording that community 100 per cent service, although it is located at the extremity of a thirty-five mile transmission line, and prior to its installation outages were painfully frequent during the peak season.

This holder has no moving parts, but consists simply of a gas-tight cylindrical chamber, thirty-six feet in diameter by thirty-five feet high, and a super-

imposed open water tank or chamber of the same dimensions. Its net capacity is 100,000 cu. ft. The lower chamber is initially filled with water which is displaced by gas admitted from the transmission line, the water passing upward through the central connecting pipe to the upper chamber. When the water is completely displaced, the lower chamber is filled with gas, stored under a pressure equivalent to the static head of water.

The reverse operation occurs when the stored gas is withdrawn. Ordinary pressure regulators control the admission and discharge of gas, thus making its action automatic. In this particular case gas is stored at a maximum pressure of 1 lb. and distributed at 5 lb. By suitable arrangement of regulators the holder may be made to simultaneously supply the local distribution system and to feed back into the transmission line; or to carry the local load only, during periods when the terminal transmission pressure falls below that required to distribute the gas. We are using the arrangement first above described, and are thus enabled to carry Azusa and Glendora from the one holder. As the amount of gas in storage is an exponential function of the static pressure thereon, we employ a specially calibrated chart which indicates directly the quantity of gas in storage. The sendout capacity of this type of holder which is restricted to the capacity of boosting machinery. A constant delivery pressure of 5 lb. was maintained, and the entire net storage of 100,000 cu. ft. discharged in forty-one minutes.

Azusa Holder Satisfactory

We are highly pleased with the results obtained with our Azusa holder, and contemplate installing additional holders of this kind, but of larger size, in the near future. Erecting this holder has enabled us to indefinitely postpone capital expenditures for larger transmission lines, amounting to several times the cost of the holder. By feeding back into transmission lines from storage at Azusa we have reduced the required initial pressure at Pomona by about 40 per cent, with consequent benefit in decreased leakage and compression costs.

This type of holder possesses many advantages over the low pressure type, among which are the following:

Lower first cost per unit of capacity.
No attendance.
No operating expense.
No moving parts.
Appearance less objectionable.
Less ground space occupied.
Lower maintenance, as all parts are accessible for painting.
High relative sendout capacity.

Some of the above statements are predicated upon the assumption that gas cannot be successfully distributed at the pressure delivered by the telescopic type low pressure holder. It is now generally conceded that this practice is not economically feasible in small or sparsely built up communities, nor under any conditions if the demand is highly variable, with the possible exception of the more congested sections of large cities. Certainly it becomes prohibitively costly if applied under the load conditions prevailing in southern California, and the practice is almost non-existent hereabouts, except during off peak periods.

In this connection it might be noted that under the service standards prescribed for California gas utilities the capacity of a three-inch main operating at 5 lb. pressure is equal to that of a seven inch low pressure main. The relative investment in the two types of distribution system may readily be inferred from this comparison.

Reverting to the report of the A. G. A. committee, "It is evident that a great number of small holders more nearly approach ideal conditions than a small number of large holders, but the operating costs might render the large number impractical," we believe that the automatic high pressure holder completely eliminates the objection referred to.

In concluding, the following conception is offered of an ideal gas system which is particularly adapted to local conditions:

Distribution

Small Towns Fed from Transmission Lines.—A single holder near the load center of each town feeding distribution mains direct at 2 to 10 lb. pressure.

Large Cities Supplied Either from Transmission Lines or Central Generating Plants, or Both.—High pressure trunk lines operating at 20 to 60 lb., feeding several high pressure holders located at load centers of the corresponding sections of the city. These holders absorb all fluctuations in the load upon transmission lines, compressors and generators, and deliver to distribution mains at a pressure of 2 to 5 lb. all gas except that which can be economically sent out directly to distribution from the source.

Demand Regulation.—All gas, except off peak industrial, which is on a shut-off basis, regulated by a demand limiting device of some sort.

Two-Part Rates

Domestic and commercial schedules to be two-part rates in which the consumer charge is combined with the demand charge—since both these elements are fixed in any given case—plus a uniform charge for gas consumed.

Heat Flow in Coal

In connection with a study of the flow of heat in coal being made by the Bureau of Mines at its experimental coal mine near Pittsburgh, Pa., the problem of determining the rate of flow of heat from the ventilation air into the coal at the experimental mine has been attacked by making use of a standardized flow plate inlaid in the coal walls of the mine. This plate consists of a sheet of lead three-quarters of an inch in thickness and 3 ft. in diameter. Thermocouples mounted in the opposite faces of this plate enable the operator to determine the temperature gradient across it, and, knowing the thermal conductivity of the lead, the quantity of heat flow into or out of the coal follows immediately. The conductivity of the coal is also computed by using these data, together with the temperature gradient in the coal. This gradient is found by means of a large number of thermocouples which are located at various positions in the mine wall.

A New History of the Gas Industry

The Illinois Committee on Public Utility Information has just published an interesting and informative pamphlet entitled "History and Development of the Gas Industry." The booklet is intended primarily for use in schools, and traces the development of the use of gas from the early discoveries down to the present day and outlines some of its future uses.

The booklet, according to the sub-title, tells "How gas—the modern heat—born in an age of superstition, was the first of great discoveries which led the way for the period of greatest progress since the dawn of civilization." In a foreword, the use of fire and its influence upon the development of civilization is traced from the days of the cave men. It is pointed out that gas makes the modern fire and that "the introduction of gas lighting marked an important epoch in the progress of civilization. Gas was the first of the number of great discoveries and developments which made possible, during the last century, greater progress and development in the world than in all the thousands of years of civilization which preceded it."

The opening chapter of the booklet is devoted to the discovery of gas and the activities of Van Helmont, Murdock, Winsor and others, and the introduction of street lighting with gas in London, which paved the way for the successful utilization of gas. The second chapter traces the development of the use of gas in the United States from the first street lighting in Baltimore. It describes the improvements made in gas lighting by the invention of the incandescent mantle, and tells how gas came to be used for cooking and purposes other than illumination.

"The Future of the Gas Industry" is the title of a chapter which discusses the increasing use of gas in industry, and considerable space is devoted to the smoke nuisance and the waste and extravagance of burning coal raw. Some interesting data on the damage and cost of smoke are contained in this chapter, which points out that the use of gas and coke for heating will not only conserve coal resources but will eliminate the smoke evil from the cities.

Another chapter is devoted to the manufacture and distribution of gas, and tells how the gas companies of the country are operated and regulated. This chapter contains the 1921 statistics on the consumption of gas, number of gas consumers, number of gas-burning appliances in use and other data regarding the magnitude of the industry. A discussion of candle-power requirements and heat-unit standards is also included in this chapter, and it is pointed out that the modern tendency to-day is to sell gas on a B.t.u. basis.

A chapter is devoted to by-products of gas, a list being given of some of the commodities which are manufactured from the by-products of gas plants.

Concluding chapters give descriptions of the process of manufacturing both coal and carbureted water gas, and the operation of a gas meter is explained. The booklet is illustrated with a simplified diagram showing the interior of a gas plant, illustrating the various steps in making carbureted water gas. The inside of a gas meter, showing how it works, and a diagram of meter dials, with instructions for reading a meter, are other illustrations.

Power Exposition in New York

The National Exposition of Power and Mechanical Engineering, which is to open at the Grand Central Palace on Thursday, December 7, will clearly demonstrate to the general public that the engineer is a tremendous force in civilization to-day. To show the general public how much it needs the engineer is a very important purpose of this exposition. But, further, engineers themselves to be successful must specialize, and few can keep in touch with the great strides that are being made in other fields of engineering than those with which they have immediate contact.

The great diversity of exhibits insures the particular appeal that this exposition will have to all engineers, as it will permit them to learn quickly and thoroughly of the progress in the arts and sciences of mechanical engineering. All industries using heat or power in any form will be interested in the displays of steam turbines, steam engines, steam boilers, feed-water heaters, superheaters, economizers, metering devices, stokers, coal-handling apparatus, valves and pipe fittings, and the thousand and one important details that enter into what is known as a power house.

The American Society of Mechanical Engineers will have a headquarters booth at the Grand Central Palace, at which all of the members will be made welcome and services extended. Members of both of these societies will be admitted to this exposition by display of their badges or on presentation of their membership cards.

The advisory committee, which is keenly interested in establishing the importance of the engineer in present-day civilization, is made up of Irving E. Moultrop, of the Edison Electric Illuminating Company of Boston, chairman; Dexter S. Kimball, president of the American Society of Mechanical Engineers; Alexander G. Christie, chairman power division, A. S. M. E.; Fred Felderman, national president National Association of Stationary Engineers; Milan R. Bump, past president National Electric Light Association; N. A. Carle, vice-president Public Service Production Company of New Jersey; E. B. Katte, chief engineer electric traction, N. Y. C. R. R. Company; Fred R. Low, editor *Power;* David Moffat Myers, consulting engineer; Calvin W. Rice, secretary the American Society of Mechanical Engineers, and the managers, Charles F. Roth and Fred W. Payne, with offices in Grand Central Palace.

Cuts Its Gas Rates

The Holdenville (Okla.) Gas Company has applied to the corporation commission seeking permission to reduce gas rates in that city. The company found that it could stimulate its sales of gas for manufacturing purposes and still do business at a profit at rates which would be slightly lower than those which had previously been in effect, and therefore applied to the corporation commission for permission to reduce rates as follows: For the first 100,000 cu. ft. used in one month, 35 cents per thousand; for the next 400,000 cu. ft., 25 cents per thousand; for the next 1,000,000 cu. ft., 15 cents per thousand, and for all over 1,500,000 cu. ft., 12 cents per thousand. The rates were agreed upon by the company and the manufacturing interests of Holdenville.

How to Combat Formation of Slag on Boiler Tubes

Conclusions Arrived at After Extensive Tests of Coals for Slag-Forming Properties

By HARRY H. BATES, Assistant Engineer, Stoking Department, Westinghouse Electric & Manufacturing Company

The trend of recent boiler and stoker development is toward the extremely large units, which are operated at capacities far beyond those that were considered normal a few years ago. The fact is that it is a daily occurrence to hear of boiler stations operating at 300 of rating or more, and it is by no means unusual that 400 per cent of the rated capacity and more are reached.

These large boiler and stoker units with their large grate areas and high gas velocities caused by high capacities, have brought about problems that have reached considerable magnitude in the combustion field of engineering. Most of these problems have existed ever since coal has been used for fuel purposes for steam generation, but until quite recently the small, easily accessible units used did not serve to indicate the extent of the trouble that would be involved. With the introduction of the large units it has become necessary to study these problems, and experiment in furnace construction in order to eliminate, as far as possible, the difficulties encountered.

One of the most serious, as well as most baffling, of these problems is the formation of slag on boiler tubes. This is a problem that can become serious.

Six Months of Investigation

To determine the exact means by which the material is deposited and the chemical reactions that actually take place is a very difficult task, but, after six months' investigation of the subject, certain deductions were arrived at. During the entire investigation it was constantly borne in mind that to effectively overcome the slag problem it would first be necessary to establish the cause of its formation, how it is carried up to the tubes, and the form in which it is deposited.

In discussing the problem of slag formation on boiler tubes, it is well that a brief discussion be given on the formation of clinkers in the furnace itself. The slag found on the boiler tubes and furnace walls is of the same material as the clinker that is discharged from the furnace, and the causes of one are to a large extent the causes of the other.

The principal constituents of ash are silicon dioxide (SiO_2), aluminum oxide (Al_2O_3), ferrous oxide (FeO), ferric oxide (Fe_2O_3) and lime (CaO). There are other materials present, but they are in such small quantities that their presence and effect are practically negligible and will not be discussed in this paper. Table 1 shows the atomic weights of the principal constituents of ash as well as their fusing temperatures.

TABLE 1

Principal Constituents of Ash and Their Fusing Temperatures

Oxide	Formula	Atomic Weights	Fusing Temps. Deg. Fahr.
Silicon dioxide	SiO_2	60.30	3,227
Aluminum oxide ..	Al_2O_3	102.20	3,416
Ferrous oxide	FeO	71.84	2,586
Ferric oxide	Fe_2O_3	159.68	2,840
Lime	CaO	56.07	3,452

Table 1 is of particular interest because, with the one exception of ferrous oxide, there is not one of the principal oxides of which the ash is composed that will fuse at ordinary furnace temperatures alone. It is when these oxides are heated in intimate contact with each other that the real clinker forming properties present themselves. The basic oxides act as fluxes on the silica present with a lowering of the fusing temperatures of the combined material. The fusing temperature is dependent upon the oxides that are brought in contact with the silica and the proportion of each. These basic oxides, together with the silica, form monosilicates of the general form of $CaO(SiO_2)$, etc. These monosilicates have a very much lower fusing temperature than the oxides of which they are composed. It may be said that ferrous silicate alone, or in combination with lime up to about 40 per cent of the total ash, will give a fusing temperature well below ordinary furnace temperatures.

Geological Survey Tests

Tests made by the United States Geological Survey indicate that the tendency of ash to clinker is increased as the per cent of iron increases, but this may not be true invariably.

Iron combines with the silica in the form of ferrous or ferric oxides, but not in the form of sulphides; however, it is only a matter of supplying heat and oxygen to convert the iron into its ferric state.

The percentage of sulphur found in an ultimate analysis of coal is frequently blamed for the excessive formation of clinkers, but sulphur is not a slag forming material in itself. It is usually found in the fuel as sulphates or pyrites which is ferric sulphide. The sulphates are not troublesome to a great degree, but the larger portion is in the form of pyrites and it is the iron in this combination that really is the disturbing factor.

(*Continued on page* 272.)

As the Journal Views It

A Public Utility Advertising Club

The meeting of advertising and publicity men of the public utility business held recently in Chicago was a step that deserves the support of every gas company executive. We are advised that out of the meeting there probably will come a branch organization of the Associated Advertising Cubs of the World.

The need for such an organization has been growing, and it has been apparent to those who have watched the situation closely that unless some definite action was taken along these lines there was a strong likelihood of trouble with some of the publishers of daily newspapers in certain sections of the country.

Publishers, it is said, have felt that there was an effort being made by all branches of the utility business to spread propaganda that rightly belonged in the advertising columns rather than in the newspaper section. They believed that the attitude of the papers, which except in some few cases has been fair to utilities, has created a lot of sentiment against unjust attacks by politicians. Undoubtedly this is true; and while utility men have had a hard fight to gain this recognition, nevertheless the result has been exactly as pointed out. Newspapers publishers feel now, it is said, that not only should they receive spasmodic advertising, such as has been given in connection with sales, but that definite appropriations should be made for continuous advertising.

A splendid example of what can be accomplished in persistent advertising is the Peoples Gas Light & Coke Company, Chicago. This company, it is generally acknowledged, has helped not only itself by its broad policy but it has also been of real service to the gas industry.

From reports of the meeting of advertising men we gather that it will be only a short time before they become affiliated with the Associated Advertising Clubs of the World and will have definite recognition from all publishers. We earnestly advocate that every gas company do all within its power to support this movement and the permanent organization when it is completed.

Promotion as It Sometimes Is

Just the other day we came across a clipping from a small newspaper in which it was stated that a prominent gas engineer had visited that town with the idea of finding a location for a factory which was to manufac ture a certain kind of necessary equipment for the gas industry. This man's proposition was that the town provide the site for the building, which, according to his statements, was to be a huge beehive of activity and which would be sure to make that town prosperous beyond anybody's dreams.

In his interview with the local newspaper this promoter declared at the start that his company was all financed and was prepared to begin the erection of the building at once. But before the interview was ended he naively stated that there were a few shares of stock for sale that would allow natives to get in on the ground floor.

This man gave estimates as to the output of his factory and of the crying need of the gas industry for the particular equipment they were planning to manufacture. But his description of his product was vague, and was not to replace any equipment now in use but was to be used as an adjunct.

We are not in a position to say whether this man actually is a gas engineer or not, nor did he state in his interview what his connection with the industry had been. Neither did we recognize the name of the firm which he claimed to represent. But we feel safe in asserting that there is not a gas equipment manufacturer connected with the company, nor has he received the indorsement of any gas company. On the contrary, we are strongly inclined to the belief that it is an enterprise that lacks many of the elements necessary to success.

The public has been educated to the fact that securities of any recognized equipment or appliance manufacturing company, as well as gas company stocks and bonds, are a splendid investment, and he is taking advantage of this widespread knowledge to float a pet scheme. Our advice to the town in question—in which, incidentally, there is no gas company—is to fight shy of any proposition which has not the stamp of approval of somebody competent in the gas industry needs and wants.

How to Combat Formation of Slag on Boiler Tubes

(*Continued from page* 370.)

The United States Bureau of Mines has made an extensive research of the sulphur forms in coals. Table 2 gives the relative proportions of the several forms, as obtained from their technical paper No. 254, by A. R. Powell

TABLE 2

Sulphur Forms in Coals

Upper Freeport, Pa.—	
Pyritic sulphur	0.47
Sulphate sulphur	0.07
Organic sulphur	0.62
Total sulphur	1.16
Per cent of pyrites in total sulphur	40.50
Pittsburgh, Pa.—	
Pyritic sulphur	0.79
Sulphate sulphur	0.23
Organic sulphur	0.66
Total sulphur	1.68
Per cent of pyrites in total sulphur	47.00
Pocahontas, W. Va.—	
Pyritic sulphur	0.08
Sulphate sulphur	0.01
Organic sulphur	0.46
Total sulphur	0.55
Per cent of pyrites in total sulphur	14.50
Elkhorn, Ky.—	
Pyritic sulphur	0.13
Sulphate sulphur	0.04
Organic sulphur	0.51
Total sulphur	0.68
Per cent of pyrites in total sulphur	19.10
Coal Creek, Tenn.—	
Pyritic sulphur	1.75
Sulphate sulphur	0.71
Organic sulphur	1.78
Total sulphur	4.24
Per cent of pyrites in total sulphur	41.30
Cherokee, Kan.—	
Pyritic sulphur	1.99
Sulphate sulphur	0.32
Organic sulphur	0.71
Total sulphur	3.02
Per cent of pyrites in total sulphur	66.00

It will be noted that the pyritic sulphur comprises from 40 to 60 per cent of the total sulphur, except in the Pocahontas and Elkhorn coals, and these coals are generally considered very high-grade steaming coals and give a minimum of clinker trouble. If sulphur accompanies the mixture it retains its form as ferrous sulphide, and this material, in conjunction with siliceous matter, makes an even more easily fusible mass than those already given.

The Problem Stated

The above discussion of clinker formations also applies almost in its entirety to slag formations on boiler tubes and walls. The condition is suggested that the iron must be kept in its ferric state, which is practically infusible. This can only be done by completely oxidizing the sulphur and iron before the tubes are reached. No free oxygen passes through a well-broken-up fire (United States Bureau of Mines, Technical Paper 139 and Bulletin 135). Unless excess air is added over the fire an incomplete combustion of carbonaceous matter and other oxidizable substances results. For this reason it can be considered with reasonable surety that complete oxidation of all slag-forming constituents cannot be accomplished within the limits of the fuel bed proper. The inherent characteristic of the underfeed type of stoker to burn fuel more rapidly over the tuyere rows than over the retorts aids materially in supplying the required distribution of oxygen for the complete oxidation of all oxidizable matter; but even with this type of stoker, slag formations on the tubes and furnace walls are a serious problem with some coals.

It can here be said that all types of stokers—underfeed, overfeed and chain grates—have difficulty with slag formations. Even a low velocity gas from a quiet fire on a natural draft stoker will carry quantities of this slag with it and deposit it on the tubes and walls.

Carried Up with the Draft

The above facts, especially those concerning the slag being carried to the tubes at all boiler ratings and gas velocities, suggest that the slag particles are carried up with the draft in such minute form that they can be carried with the low velocity gas as well as the gas that rises rapidly. An examination of the slag under a microscope revealed small spherical globules, which substantiated the belief that the particularly troublesome particles were the small ones.

When these little particles come in contact with the free oxygen in the furnace gas for a sufficient time to completely oxidize them, they will be transformed into their completely oxidized state and become solid. If they solidify before touching the tubes or walls they are carried through the boiler as solid ash. On the other hand, it has already been pointed out that no free oxygen is obtained through the fuel bed. In this event the particles remain in a molten condition, on account of their low fusing temperature in their -ous state, and are deposited on the tubes and walls, where they may either be completely oxidized and solidified or be covered by successive coatings or layers of the same plastic material. That the latter is true to a large extent is shown by layers of a very dark vitreous material covered by a reddish brown layer or protective coating. This reddish coating is largely ferric material, and it prevents further oxidation of the dark ferrous material within by excluding the oxygen from it. A considerable portion of the material on the outer surface, especially on the tubes, is of a friable and non-fusible character, and it is of a completely oxidized nature.

To Admit Excess Air

A number of manufacturers of stokers and stoker auxiliary equipment have produced equipment for supplying excess air over the fire in order to completely

burn combustible gases. They have undoubtedly accomplished some beneficial results, but even now there is yet considerable research and experimental work to be done on the extra large, superpower station-type of boilers. The extreme size of these furnaces makes correct distribution of air to the furnace an extremely difficult problem to solve. The nearest approach to a suitable device so far developed is an installation with perforated cast-iron air-distributing boxes above the throat of the stoker.

Another type of equipment frequently used for this same purpose is the ventilated wall of perforated firebrick. This method is satisfactory for the ordinary size of furnace, but for the larger units a very strong jet action is required to force the air to penetrate the rapidly rising volume of gas to a distance sufficient to oxidize the particles in the center of the gas passage. These devices serve well for protecting the boiler walls, but cannot be considered as suitable for slag prevention in large furnaces.

Even if some efficient means is developed for mixing the gas and excess air together, it is very questionable whether the slag difficulty will be entirely overcome. It is to be remembered that, in addition to the problem of supplying and mixing the oxygen and combustible gases, time is required for the various chemical reactions to take place.

There is but little chance for thoroughly mixing all gases in the combustion chamber, as the rapid rate with which the gases ascend prevents a thorough mixing and a stratification of the gases results. An illustration of this is shown in Chart No. 1. These figures are values of CO_2 from gas samples taken under every second tube and at 2-ft. intervals along the tubes.

CHART NO. 1

Shows Analyses of Samples Taken from First Pass Baffle Opening Immediately Under the First Row of Tubes

Tube No.—				Vertical Baffle						
	41	37	31	27	23	19	15	11	7	3
CO_2—										
	10.6	11.0	11.4	15.0	15.3	16.2	13.0	12.4	13.4	10.5
	10.1	12.0	14.0	16.0	17.5	13.4	13.0	12.8	12.8	13.0
	10.0	12.8	15.5	16.5	17.8	13.0	14.5	13.7	10.2	13.7
	11.9	10.5	14.9	15.7	17.9	14.3	14.0	14.3	13.4	10.6

Front Wall

These readings showed a carbon-dioxide content of from 10 per cent along the walls to 17.5 per cent in the center. From these figures it can be appreciated that the chances for the ferrous material to change into the ferric state are very few. It was very evident that there was an insufficient penetrative effect from the ventilated walls to take care of the wide furnace, and also it is noted that there was considerable excess air along the walls.

Composition of Slag

Numerous samples of coal, ash and slag were analyzed, the last of which are particularly interesting because they corroborate the above conclusions. Table No. 3 gives a typical analysis of the slag taken from both the boiler tubes and the furnace walls.

TABLE 3

Typical Analyses of Slag

	Per Cent
Sample of Slag Taken from Furnace Walls:	
Ferrous iron	8.26
Ferrous iron calculated to ferric iron	9.18
Ferric iron, found as such	6.71
Total iron	15.89
Ratio of ferrous iron to total iron	57.70
Sample of Slag Taken from Boiler Tubes:	
Ferrous iron	3.23
Ferrous iron, calculated to ferric iron	3.58
Ferric iron, found as such	8.71
Total iron	12.29
Ratio of ferrous iron to total iron	29.10

It is interesting to note that the slag on the furnace walls ran much higher in ferrous iron, by per cent, than did the slag on the tubes. In consequence of this the slag on the walls was much freer from the coarse friable infusible material than was the material on the tubes. The hard vitreous appearance of the slag on the walls gave evidence of having been there in a molten and flowing condition until such time as the furnace was cooled below the fusing temperature of the mass. The smooth appearance of the wall shown on plate No. 2 as compared with the rough material on the tubes, shown on plate No. 1, further verifies this point.

Numerous Theories Advanced

Numerous theories were advanced during this investigation as to the causes of slag formation on the tubes. Chief among these was the condensation of tarry vapors on the tubes to which the flying particles could adhere and solidify. It is true that the coal contained a high percentage of volatile matter and was rich in tars, but that this had a material effect in the formation of the slag is highly improbable. If tarry vapors existed in the ascending gases and actually condensed on the tubes any coating on the tubes would be extremely thin. Tars are fairly good heat insulators and only a very thin coating of tar would form before it would begin to burn away when subjected to the furnace temperature, which at times was 2,800 3,000 deg. Fahr. Even if the lack of temperature permitted the film of tar to form on the clean external surface of the tubes, the insulating effect of a very thin layer of slag would prevent further condensation of tar. That this did occur was borne out by the fact that only about 1/16 in. to 1/8 in. of the slag on the tubes remained there in a completely frozen state. The melting point of the slag was 2,138 deg. Fahr., which is much above the vaporizing temperatures of any tars in the fuel and, consequently, a condensation of these tars would be impossible.

As commonly found in furnaces of all kinds, a considerable amount of visible solid particles were carried up with the rising gases. On the clean tubes these did not appear to have any effect, as they simply struck the tubes and rebounded, sometimes falling back in the furnace, or were carried through the boiler with the gases. Chart No. 2 is interesting in that it shows how rapidly the draft loss increased across the two lower rows of tubes, after an adhesive coating of molten slag had formed on the under sides

of the tubes. After this coating had formed a great portion of the solid particles struck and adhered to the plastic material and the rapidity with which the slag formed was greatly increased, both by this and the rapidly growing area presented for contact.

On the large number of tests made it was indicated that the slag deposit on the tubes was nearly proportional to the total amount of gas, and was not greatly affected by the rating. The amount of slag was affected by temperatures in the furnace, however, for the hotter fires kept the slag in a more viscous state, which greatly increased the tendency for cinders and particles of ash to adhere.

To Prevent Slag Accumulation

As previously stated, the slag problem is a chemical one and the desirable remedy would be a chemical remedy, providing the cost of maintaining chemical action is not excessive. Such action may be set up in three different ways:

1. By feeding some material in with the coal that will act as an oxidizing agent.
2. By feeding some vapor in with the air supply, which will dissociate and permit its oxygen to combine with the ferrous material present.
3. By intimately mixing air, at high temperature, with the rising particles, so as to completely oxidize them before reaching the tubes.

By analysis of these three courses for experiments the first one was eliminated without trial. It was not considered feasible to feed any solid oxidizing substance in with the coal. The first cost would certainly be prohibitive, besides a greater amount of ash would have to be handled.

The second procedure was tried out by the injection of steam into the air supply. No decrease was noticed in the formation of slag on the tubes.

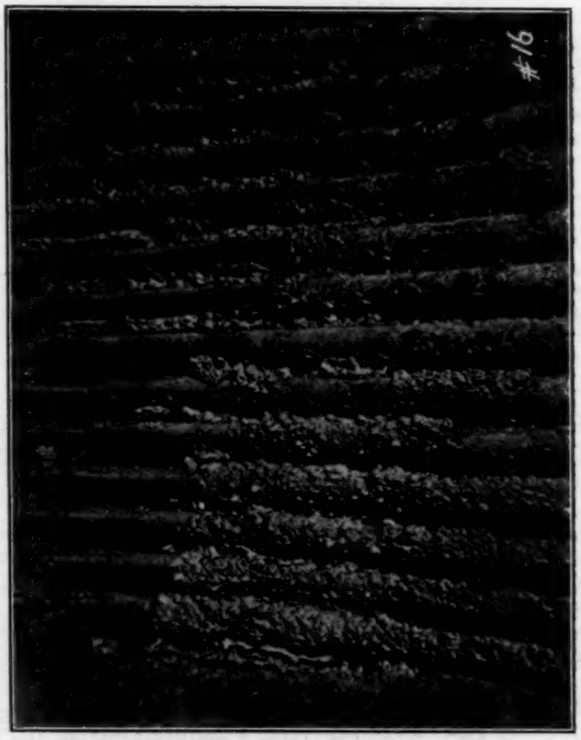
It is to be remembered that at no place in the fuel bed, except on the dumps, could the ash have been over 50 per cent of the total fuel bed. Further, the ferrous material was not over 10 per cent of the ash. It is, therefore, apparent that the ferrous material, representing a maximum of 5 per cent of the total fuel bed, had but little chance of coming in contact with the liberated oxygen and solidifying in its ferric state.

Introduction of Water Vapor

In reality this was expected as it was deemed impracticable to put enough water through the fuel bed to insure complete oxidization of the ferrous material with all the other combustible matter present.

More recent experiments have shown that the introduction of water vapor into ash and refuse undoubtedly prevents a spongy mass of clinker from adhering together. This, however, is a vastly different proposition from the former as it is necessary only to oxidize the surface to prevent adhesion where about 80 per cent of the material present is incombustible.

The third method suggested, namely by intimately mixing air with the gases, is now being tried. The original boilers were set about thirteen feet from the grates. It was thought that, by increasing the distance between the grates and boiler tubes, the gases would have more opportunity to mix thoroughly. Also, since the total time of travel of the furnace gas is dependent upon the velocity and distance of gas travel, more time would be allowed for complete oxidation of the small particles. Consequently, a boiler was set up six feet higher than those originally installed.



Formation of Slag on Boiler Tubes

Assuming that the rapidity with which the gas rises from the fuel bed is uniform, it is calculated that its velocity was about eighteen feet per second. This is the lowest possible velocity that can be expected. The direction of gas travel is from the grate direct to the baffle opening, which was proportioned as 46 per cent of the grate surface. Necessarily the velocity was twice as high under the baffle as it was leaving the fuel bed.

On this basis, the time it took for particles to reach the tubes with the original installation would be:

$$13' \div 18' = 0.72 \text{ seconds.}$$

This is very little time for oxidation to take place, unless it is of an explosive character. Further, by raising the boiler to 19′ this same time would be:

$$19' \div 18' = 1.05 \text{ seconds,}$$

which is still of very short duration.

This arrangement has not shown any great improvement in slag prevention and has the disadvantage of exposing more brickwork to high temperatures and to draft with resulting greater infiltration of air through the setting.

Furnace Construction a Factor

Furnace construction undoubtedly has much to do with the external incrustation of the tubes with slag. The ratio of the exposed tube surface to the grate area was 1 to 1. This is very low, and the lower the ratio under set conditions of fuel and fuel bed the higher will be the furnace temperature. It is apparent that the higher the furnace temperature the greater will be the tendency for the ash to fuse and stick.

It has become common practice now to have the ratio of exposed tube surface to grate surface as high as 1.87 to 1, and is seldom less than 1.2 to 1. By increasing this ratio the amount of heat radiated up and absorbed is very materially increased, with a consequent reduction in furnace temperature.

This last item—namely, furnace construction—is a step in the right direction. Unfortunately, the construction of the investigated installation did not permit changing the ratio (1 to 1), and for comparative purposes it was necessary to refer to a neighboring station with a similar type of stoker and boiler, and which used a similar coal. This second plant has had practically no trouble with slag on tubes, and uses only the soot blowers while the boilers are in operation.

An interesting difference in the two stations was that the first two rows of tubes in the former were staggered, and slag impinged on and stuck to both rows. The second row caused more trouble than the first row, as the slag took the form of icicles or stalactites, and when they became long enough and the velocity of the gas became high enough the "icicles" bent sideward until they touched the lower tubes. This effectively sealed the gas passage of that part of the boiler. (See Chart No. 3.)

The second installation had the first two rows set one above the other. The material which struck the bottom row of tubes adhered, but the rapidity of the formation was far less. On account of this arrangement, the gases were sufficiently cooled by passing between these tubes to prevent the slag from sticking and there was no further tendency for the slag to adhere to the boiler surfaces.

For Improved Boiler Design

When it is considered that the ash is very finely divided in the coal and that some of it is certain to be carried up with the gas, it appears that the most fruitful field for development of means for slag prevention is in furnace and boiler design. This belief has already been justified. At the same time there is still need for further development of apparatus for mechanically removing soot and slag from boiler tubes.

From the foregoing it is seen that the chemical composition and fusing temperatures of the ash were known, and a careful and complete record was obtained of all happenings in the furnace and around the boiler. With the aid of this information and the assistance of the United States Bureau of Mines, evidence was obtained that has led to the above general conclusions.

Considerable value was received from this investigation, because much was learned of the effect of furnace, boiler and stoker construction on the slag problem.

It is extremely fortunate that only a comparatively few coals give slag trouble to a serious degree. A great many coals have fusing temperatures so high that they give no trouble with ordinary furnace temperatures. Another class of coals have low fusing temperatures but do not seem to have the tendency to be lifted from the fuel bed. But when a coal gives serious slag trouble, with the present knowledge of the art of burning coal, means must be provided for its mechanical removal. This, however, is not as serious a matter as it appears, for soot blowing in boiler plants is now recognized as a necessity and apparatus for soot removal is now installed as regular boiler equipment.

The accompanying illustration shows the action of slag on boiler walls and tubes.

Future of Gas Business in West Virginia a Big One

Harry A. Wallace, retiring president of the West Virginia Oil and Gas Association, in his annual address before the convention at Clarksburg, W. Va., gave some interesting figures regarding the gas business in the State of West Virginia. Among the statements made by Mr. Wallace was the following:

"The West Virginia Oil and Natural Gas Association is the largest organization in the State of men engaged in a common industry. Ninety-five per cent of the men engaged in the oil and gas industry, which is the greatest of any industry in the State, are native West Virginians. This organization stands for the advancement of everything that is for the benefit of the commonwealth.

"I feel that the corner of industrial depression has now been turned and the time will soon return when there will be a resumption of active operations in the various branches of the industry. Due to the depression, resulting in decreased consumption of refined products, resulting in a production of approximately 250 barrels of oil less in 1921 than in 1920, the decrease in the production of natural gas in 1921 as compared to 1920 was fifty-five billion cubic feet.

"In 1921 the valuation placed on the oil and gas companies in West Virginia was $123,819,734, and the taxes paid, exclusive of all Federal taxes, amounted to $2,257,767.95; or, in other words, our industry is paying about one-fourth or one-fifth of all the State taxes.

"In 1921 there were in West Virginia 134,372 domestic and 1,367 industrial consumers of natural gas. The domestic consumers used nineteen billion cubic feet of gas and the industrials twenty-eight billion cubic feet.

"I trust that during the coming year every man identified with us will join the association, as it is his duty to assist an organization designed to promote the welfare of the business in which he is engaged. Single-handed we accomplish little, but united we cannot only protect ourselves against discrimination but also render valuable assistance to causes beneficial to all."

New officers elected by unanimous vote of the convention are: President, B. F. Robinson, Clarksburg; vice-president, James H. Dye, Charleston; secretary-treasurer, Edwin Robinson, Fairmont.

The directors are: P. McDonough, Charleston; E. L. Keller, Charleston; Harry A. Wallace, Charleston; J. J. Evans, Clarksburg, and Ira G. Sayre, of Charleston, who replaces J. H. Dye, who was made vice-president.

Developments in Gas Technology

Important Information Gathered from All Parts of the World

By ISMAR GINSBERG, B.Sc., Chem. Eng., Associate Editor

Registering Flow of Gas

In a close cylindrical chamber, free of any dividing partitions, there is a vane pivotally mounted on a spindle or pivot co-axial with the chamber and carrying a pointer or needle designed to move over a graduated dial against the action of a spring. The spring is wound up by the movement of the vane under the flow of gas, and unwinds when the flow ceases, returning the pointer to the zero position. (British Patent No. 181,439.)

Gas Producer with Endless Belt Feed

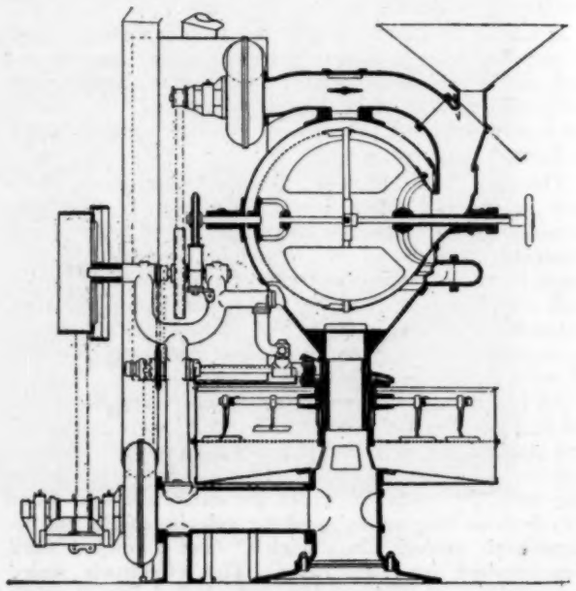
In German Patent No. 351,279 there is described an apparatus for the carbonization of coal, which is provided with an endless belt on which the material to be carbonized is fed into the internally heated furnace. The gas offtake is located immediately below the trough of the perforated endless belt, which is loaded with the raw material. The gases evolved are therefore immediately removed from the hot zone of the furnace and are not subjected to overheating. This arrangement is also advantageous in preventing the decomposition of the tar.

Lubricating Oil from Coal-Tar Oils

Another patent on a process of making viscous lubricating oils, suitable for the lubrication of heavy duty bearings and steam cylinders, from coal-tar oils. The process is patented in German Patent No. 350,801. It consists essentially in treating the oils at the ordinary or higher temperature with an acid condensing agent other than sulphuric or waste acid. Suitable condensing agents are sulphuryl and thionyl chlorides, phosphorous chlorides, phosphorous oxychloride, aluminum chloride, phosphorous pentoxide and sulphur dichloride. Anthracene oil, with a flash point of 140 deg. Cent. and a viscosity of 4.6 deg. Engler at 40 deg. Cent., gives on treatment with sulphuryl chloride and removal of the hydrochloric acid produced a lubricating oil with a flash point of 172 deg. Cent. and a viscosity of 40 deg. Engler at 40 deg. Cent.

Gas Coffee-Roasting Machine

The accompanying figure shows a coffee-roasting machine of Swiss construction, a description of which was published in the *Monat's Bulletin*, 1922, pages 147-149. The machine consists of an upper part, in which the coffee is roasted, and of a lower part, in which it is cooled. At the right and top there is seen the feed hopper with valve controlling the flow of the green coffee into the machine. A fan is provided for sucking air into the apparatus, and after first making it pass over gas flames arranged concentrically with the roasting spherical section of the apparatus it is drawn through the green coffee. The roaster is heated externally over its entire circumference and internally as



Schnitt durch eine Gas-Kaffeebrennmaschine.

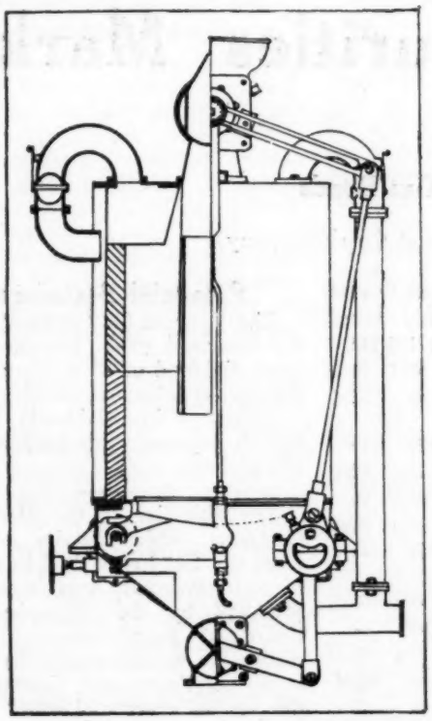
well. The rate of air flow can be regulated easily. The roasting process as carried on in this apparatus takes about fifteen to twenty minutes. The coffee is then dropped into the cooling device below, where it is subjected to the cooling action of a current of air blown through with the aid of another fan. The amount of gas consumed is small. Thirty-six kilograms of coffee are roasted and cooled in twenty minutes.

The Steaming of Vertical Retorts

Steaming of vertical retorts means the simultaneous production of blue water gas in the retort during the carbonization process. The comparatively short history of this process is discussed. Superheated steam must be used so as to avoid condensation. It has been found that steam at a constant temperature of either 500 or 600 deg. Fahr. is satisfactory for this purpose. The design of the superheater is gone into in considerable detail. Steaming of retorts produces greatly increased yield of gas and secures an increased flexibility and output from the plant. A considerable saving in coal is effected. The complete article is found in *The Gas Engineer*, May 15, 1922.

Portable Gas Producer

The diagram shows a portable gas producer which is intended for use in furnishing the fuel to drive motor vehicles. This producer is equivalent to a jet carbureter. Only a few pounds of fuel need be carried, so that the size and weight of the producer are small. The



fuel is contained in tank and fed into the producer in accordance with the requirements of the engine. The entire action of the producer is automatic. The ashes are ejected automatically and the fire is stoked automatically. The feed of coal and water is automatic and dependent on the speed of the vehicle and the load. The gas produced is of a constant quality, and by using a shallow fire, all of which is in a state of incandescence, and feeding fuel in small, regular amounts, all troubles due to distillation of fuel are overcome, so that a dust remover rather than a scrubber is all that is required to deal with the gas before it passes to the engine. The producer was tested out for marine work by the British Admiralty and was found to demonstrate an extraordinary economy, speed for speed, as compared with running on gasoline. The complete article is found in *The Gas Engineer*, May 15, 1922.

Natural Titanium Oxide Paint for Gas Works

It is reported in *The Gas Journal*, May 10, 1922, that a natural titanium oxide paint of slate-blue color was used with very successful results in gas works. The paint adhered well to iron, wore well, and the surface was in good condition for repainting.

Coal Out of River Beds

The straits to which utility companies have been brought in their endeavor to obtain coal to maintain a continuous service to the public are proved by the fact that more than one community is kept going by the burning of coal dredged from the beds of streams in the Pennsylvania coal fields. Anthracite is still extremely difficult to obtain, and this coal, hitherto considered waste, is now being recovered and used to make light and power for many citizens of the Empire State.

For many years—up to fifteen or twenty years ago—it was considered impracticable to offer for any use smaller sizes of anthracite than pea. Therefore, when coal brought from the mines in big chunks was put through crushers and washers, the small bits were washed away as waste with the water and went into the stream beds. In the course of many years these small bits of coal filled up the channels of the East Branch of the Susquehanna, the Shamokin and the Mahanoy, and other streams running through the anthracite field, and gradually overflowed the banks. This coal deposit has slowly spread over adjacent farm lands, in places to a width of a thousand feet. Coal has been carried down the Schuylkill as far as Philadelphia, and down the Susquehanna almost to Chesapeake Bay.

Now, with the coal shortage affecting industry all over the country, reclamation plants have been started, chiefly along the Shamokin and Mahanoy creeks, because of good railroad facilities there. Either by pumps operated on shallow-draft barges, or by land plants operated in connection with bucket dredges, the coal is brought up and run over screens of various sizes which permit the washing away of sand and the grading of the reclaimed coal according to size. The largest sizes of this coal are sold for domestic use; the greater quantity of it, however, which is of the size known to miners as "barley," is used by industrial plants and utility companies. The reclaimed coal has just about the same characteristics as fresh-mined coal coming from this district, notwithstanding its long submersion. Surveys indicate that on one small section of Mahanoy Creek, where the coal bed varies from 3 to 14 ft. in depth, there lie available for recovery about 500,000 tons.

Heating Furnace Efficiency

Increased operating costs and keen competition have directed attention to many losses in the use of heat which were formerly disregarded. Prominent among these is the loss of heat through heat-treating furnace walls. Furnace design and operating is probably the most inexact branch of engineering science. This is because results can be obtained that are satisfactory even if the methods are wasteful, and because it is extremely difficult to keep an accurate record of just what goes on inside the furnace walls. Also, the prime consideration in the past has been to design the furnace to get the maximum production of high-class material, and methods of heating have only recently come to get the consideration which they must necessarily have in a period of high fuel costs.

The heat generated in a heat-treating furnace goes in part to do the heating required, and is in part lost through the walls and doors and up the stack.

The problem is twofold: (1) To provide a material having the ability to resist the action of high temperatures, sufficient mechanical strength and, possibly, the property of resisting corrosive slags, gases, etc., without spalling or being eroded; and (2) to prevent the excessive loss of heat due to conduction from the interior of the wall to the outside, where it is lost by radiation or conduction. It is rare that a good refractory material is an insulator; usually it is necessary to augment or back up the refractory with some material having a much lower heat-conducting capacity.

Public Utilities Securities Market Report

Prices of Representative Gas Bonds

(Quotations furnished by The National City Company)

Company		Maturity	Oct. 19, 1922 Bid	Asked
American Lt. & Trac. Co.	Five Year 6s	May 1, 1925	111½	112
Brooklyn Union Gas Co.	First Consol. 5s	May 1, 1945	97½	98½
Columbia Gas & Elec. Co.	First 5s	May 1, 1927	96	96¾
Consol. Gas, Elec. Lt. & Pr. Co. of Baltimore	First Ref. 7½s	Dec. 1, 1945	110	111
Consol. Gas, Elec. Lt. & Pr. Co.	General 4½s	Feb. 14, 1935	92¼	92¾
New Amsterdam Gas Co.	First Consol. 5s	Jan. 1, 1948	88	90
Denver Gas & Elec. Co.	Gen. (now 1st) 5s	May 1, 1949	95¼	96¼
Detroit City Gas Co.	Gold 5s	Jan. 1, 1923	100	—
Equitable Illum. Gas Lt. Co. of Philadelphia	First 5s	Jan. 1, 1928	99½	102
Hudson County Gas Co.	First 5s	Nov. 1, 1949	93	—
Laclede Gas Light Co.	Ref. & Ext. 5s	Apr. 1, 1934	92½	95
Louisville Gas & Elec. Co.	First & Ref. 7s	June 1, 1923	100	100¾
Michigan Light Co.	First & Ref. 5s	Mar. 1, 1946	91	93
Milwaukee Gas Light Co.	First 4s	May 1, 1927	93⅜	94
Pacific Gas & Elec. Co.	Gen. & Ref. 5s	Jan. 1, 1942	92¾	93¼
Pacific Gas & Elec. Co.	First & Ref. 7s	Dec. 1, 1940	106½	—
Cal. Gas & Elec. Corp.	Unif. & Ref. 5s	Nov. 1, 1937	96	97
Peoples' Gas Lt. & Coke Co.	Refunding 5s	Sept. 1, 1947	94	95½
Chicago Gas Lt. & Coke Co.	First 5s	July 1, 1937	96	97
Portland Gas & Coke Co.	First & Ref. 5s	Jan. 1, 1940	92¾	93¾
Seattle Lighting Co.	Refunding 5s	Oct. 1, 1949	85	87
Southern California Gas Co.	First 6s	Nov. 1, 1950	100	101½
Utica Gas & Electric Co.	Ref. & Ext. 5s	July 1, 1957	91¼	—
Washington Gas Light Co.	General 5s	Nov. 1, 1960	95¼	96
Western States Gas & Elec. Co. of California	First & Ref. 5s	June 1, 1941	92	94

Charge for Service Upheld as Just

The justness of including a service charge in a gas service bill to cover part of the fixed cost of having the conveniences of gas service available at any time of the day or night as advocated by R. B. Brown, Milwaukee, nominee for president of the American Gas Association, is upheld by the Massachusetts Utility Commission.

Its opinion as expressed in a recent decision allowing the Worcester Gas Light Company to include the service charge says:

"We have already pointed out in other decisions that this is a question not primarily between the company and its customers but between the customers themselves. In other words, certain expenses are determined by the number of customers rather than by the amount of gas they use. Such customers as use little or no gas, but desire nevertheless that their premises shall be connected with the company's mains, not only contribute little to the company's revenue but not enough to equal the company's out-of-pocket expense incurred solely for them. It is to correct this inequality that this service charge is urged. Recognizing the merit of this contention, we have been disposed to approve the adoption of this method of charge within reasonable and proper limits whenever a company has deemed this step expedient."

Financial Statements

The Vacuum Oil Company, one of the Standard group, has declared an ertra dividend of $7 a share and the regular semi-annual dividend of $3 a share. With dividends just declared, payments this year will total $16 a share.

The pipe line of the Mutual Oil Company, which carries crude oil from the Cat Creek field to the tank cars at Winnett, was assessed at $233,343 by the Wyoming State Board of Equalization. This includes the valuations put by the assessors of Fergus and Garfield counties on buildings and other properties of the company than its pipe line.

The valuation of the properties of the Gallatin Natural Gas Company, which supplies natural gas to Billings, Mont., and other points, was put at $350,759, which includes $6,900 local assessments made by Yellowstone and Carbon counties.

Missoula Gas Company Asks Increase in Rates

Helena, Mont.—Decision on the application of the Missoula Gas Company for an increase in its rates to $2.25 per thousand cubic feet of gas, with a graduated reduction for larger consumers, will be rendered by the State Public Service Commission the latter part of this month. Hearing was held by the board in Missoula last week on the application by the company, which has been in the hands of a receiver since 1918.

Additional Equipment for Elmira, N. Y.

The United Gas & Engineering Corporation, of New York, has placed orders for a quantity of 20 and 10 in. valves and piping to be shipped to the plant of the Elmira Water Light & Railway Company.

This equipment is being fabricated by the Western Gas Construction Company.

Purifying Equipment for Lynchburg, Va.

The American Railway Company, of Philadelphia, has placed an order for a duplex purifier fourteen feet six inches diameter by twelve feet high, to be built at the plant of the Lynchburg Traction & Light Company. The purifier will be equipped with the Faben trays; also there will be large cast iron doors on shell, each cover provided with a small steel crane to take care of the weight when opening the door.

An interesting feature is the use of the "Type D F" valves, one on the inlet and the other on the outlet of the new box which will enable the superintendent to reverse the direction of flow through the oxide whenever desired, or to put the two layers of oxide in series if found desirable.

The new purifier is to be fabricated and erected by the Western Gas Construction Company.

Natural Gas to Go 19 Miles to Buffalo

Gowanda, N. Y.—Natural gas from the Arkwright field is to be piped to Buffalo. A pipe line is now being laid from Arkwright to Collins, connecting with the line now supplying Buffalo on the Poss farm in that town. The line will pass through Gowanda, near the tannery, following the highway to Perrysburg, Nashville, Hyatt's Corners, thence across fields to Arkwright. The distance is a trifle over nineteen miles. The Rich Construction Company, Bradford, Pa., has the contract and sixty men are now rushing the work.

Sheboygan Gas Set Is Now in Operation

The new seven foot water gas set recently built for the Sheboygan Water Gas Company is now in operation. It is fully equipped with hydraulic cylinders on all the important valves, operated from a central control station.

The set was built by the Western Gas Construction Company.

Purifier at Green Bay Finished

The erection crew of the Western Gas Construction Company has finished work on the new steel purifier at the plant of the Wisconsin Public Service Company.

Toledo Buys Purifiers

The Toledo Edison Company has placed its order for two duplex steel purifiers to be erected on the site of the Acme power house. Each purifier will be sixteen feet six inches diameter by twelve feet high and will be equipped with two layers of the Faben trays and the and the two boxes will be joined together by a system of gate valves.

An interesting feature of these boxes is that each one will be equipped with eight doors in the shell and four doors in the crown.

The new purifiers are being fabricated and erected by the Western Gas Construction Company.

Water-Gas Equipment for Elkhart, Ind.

The American Public Utilities Company, of Grand Rapids, Mich., has placed a contract for a new six foot water gas set to be built at the plant of the Elkhart Gas & Fuel Company.

The new set is of the latest design and is being furnished by the Western Gas Construction Company, who have also received an order for a large operating floor made of cast iron plates and arranged to accommodate the space available in the present building.

Purifier Piping at Houston, Tex.

The United Gas & Electric Engineering Corporation, of New York, has recently placed an order for a quantity of 30 in. piping to be used in connection with the new purifiers that are being built at the plant of the Houston Gas & Fuel Company.

The pipe is being made by the Western Gas Construction Company, who received the original contract for the purifiers.

Rich Oil Find

What is said to be one of the richest oil finds for a long time has been unearthed in the Navajo Reservation in New Mexico, on the Hogback structure, a wildcat venture of the Midwest Refining Company. This location is not far from Farmington, N. M., which is on the Denver, Rio Grande & Western Railroad.

The oil spouted when the drill was at a depth of 830 ft., and it is extraordinarily light oil, 60 per cent gravity.

Gas Company Bonds Readily Subscribed

About half of the bond ogerings in New York during the first week of October represented financing by public utility corporations or companies, the grand total of $70,500,000 finding a good demand in investment circles. Rates over all the new utility bonds ranged from 5 to 7 per cent, while the yields varied from 5.45 to 7 per cent. Among the other utility issues was one of $7,500,000 of the American Gas & Electric Company's 6s, due in 2014, one of $6,132,000 of the Ohio Power Company and one of $2,000,000 of the Southern California Gas Company's first and refunding 5½s. All were readily taken up.

Natural Gas Field in Arkansas

Mansfield, Ark.—The Mansfield Gas Company has just brought in a new gas well producing 6,000,000 cu. ft. of gas at a depth of 2,00 ft., with a rock pressure of 320 lb.

It is planned to move the company's machinery to an old well near by, which will reopen and drill for a deep test well. This is the oldest gas field in the State, the first wells having been drilled about thirty years ago, and are still producing an abundance of gas for Mansfield and Huntington.

York, Neb., Water Gas Building

The Continental Gas & Electric Corporation has placed an order for steel roof trusses, purlins, ventilators, tile, etc., required for the new water gas building at their York, Neb., plant. This contract was placed with the Western Gas Construction Company.

Western Controls in Chicago

Erection work is now going along rapidly on the recent order for six Western automatic controls that are being installed at the Division Street station of the Peoples Gas Light & Coke Company. The Western Gas Construction Company are putting in the new equipment.

Danville Using New Holder

The 500,00 cu. ft. gas holder recently built for the Danville Street Railway & Light Company by the Western Gas Construction Company has now been put into service.

Wisconsin Spending Money Freely on Utilities

Milwaukee, Wis. — Telephone, traction, power and gas companies in nearly all sections of Wisconsin are still spending hundreds of thousands of dollars in betterments and extensions to their systems to meet new service requirements in their communities, indicating superior confidence in the general business prosperity of the State, according to advices received by the Wisconsin Public Utilities Bureau during the past week.

A few of the major improvements follow:

At a cost of $35,000, the Wisconsin Valley Electric Company will install a new gas tank holder at its plant in Stevens Point, increasing the capacity of the tanks from 75,000 to 200,000 cu. ft. of gas.

The Wisconsin Public Service Company will spend $105,000 for the construction of a twenty-two mile power line from Pound to Marinette and across the river to Menominee, Mich.

The Lake Superior District Power Company is constructing a steel-towered transmission line from Big Falls on the Flambeau River to Ashland, Hurley and other cities in the Iron Range.

A two story building will be erected by the United Telephone Company in Monroe, which will be used for warehouse and garage purposes.

A new telephone building will be erected by the Midway Telephone Company in Medford, which will contain the latest in telephone equipment.

The Wisconsin-Minnesota Light & Power Company will rebuild its entire distribution system in Sparta at a cost of $16,000.

A new telephone exchange will be erected by the Casco-Brussels Telephone Company in Casco on the same site of the one recently destroyed by fire.

The Chicago, North Shore & Milwaukee Railroad announces the purchase of forty new cars representing the parlor, dining, observation and coach types in the interurbans, and several one man cars for use on the Milwaukee city lines.

To Pipe Gas for Industrial Use

Wilmington, Del.—The Southern Carbon Company, of this city, which owns large gas interests in the Monroe, La., field, has completed arrangements for the construction of a pipe line from that field to Alexandria. The project is considered of importance since it is one of the few steps that have been taken toward supplying the industrial centers of Louisiana with natural gas from the Monroe district. The line will cover a distance of nearly 100 miles and will cost approximately $100,000.

Alexandria is to receive the gas at a flat rate, to be fixed by the city, which agrees to use a minimum amount of 750,000 cu. ft. per day and a maximum of 10,000,000 cu. ft. The city will buy the gas at the corporate limits and distribute it through a municipally owned system which is in course of construction. The contract provides that the line is to be completed by Dec. 1, 1922.

A party of officials connected with the Southern Carbon Company has been in Monroe in conference with William Polk, local representative of the company, relative to the construction of the line, consisting of F. F. Curtze, president; N. D. Bubb, treasurer; J. D. Pribble, general superintendent, and J. D. Frazier, field man.

Another Town to Get Gas

Wray, Col.—A move is on foot for Wray to have a municipal gas well for light and power in the city. The promotion of this project has been going on for the past two weeks and some of the city's business men have expressed their willingness to get behind the proposition and push it through.

The idea is to take up a popular subscription for the drilling of the well, and if enough money can be secured, to advertise for bids and accept the lowest bid for the drilling of the hole. One or two drillers have already made estimates as to the probable cost, and the promoters tell us that it will be between seven and ten thousand dollors.

Useful to Bear in Mind

There are four times as many artificial lighting hours in winter as in summer. In June, light is used in the average residence one hour and thirty minutes each day. In December, light is used in the average residence six hours and fifty minutes each day.

Bristol Holder Completed

Work has been completed on the 300,000 cu. ft. holder which was erected for the Narragansett Electric Lighting Company, of Providence, at their Bristol, R. I., plant.

This work was done by the Western Gas Construction Company.

Gasser Near Welda, Kan.

Kansas City, Mo.—A new gas field is believed to have been opened four miles northwest of Welda, in Anderson County, Kan., due to the heavy gas production being shown at a test being drilled by D. W. Polkinghorn on the J. T. Watkins farm. The gasser, with an estimated rock pressure of 250 lb., is showing an initial production of 6,000,000 ft. from a depth of 635-657 ft. The well was drilled for oil, as there is production found in that section at deeper depths. The owners have announced that the gas possibilities of that section will be further developed.

New Condenser Installed

The Lock Haven (Pa.) Gas Company is installing additional condenser capacity in its water gas plant. The order for this condenser and connections was placed with the U. G. I. Contracting Company, of Philadelphia.

Order for Purifiers

The U. G. I. Contracting Company, of Philadelphia, has orders for the installation of purifiers at the Plymouth, Ind., plant of the Northern Indiana Gas & Electric Company; also at the plant of the New Gas Light Company, of Janesville, Wis.

Barring-Down Machine

The Consumers Gas Company, of Reading, Pa., has recently ordered a barring-down machine from the U. G. I. Contracting Company, of Philadelphia. The latter Company reports that this machine has excited considerable interest all over the country.

The Allentown-Bethlehem Gas Company, Allentown, Pa., will erect a 2,500,000 cu. ft. storage holder and has given the contract for all work in connection with this installation to the U. G. I. Contracting Company, of Philadelphia.

August a Record Month for Gasoline Consumption

Washington, D .C.—A new high record for consumption of gasoline in the United States was attained in the month of August, according to statistics compiled by the Federal Bureau of Mines, which show a domestic usage of 583,687,932 gal. Consumption of gasoline in August was 3.1 per cent greater than in Ju'y, in which month a record consumption mark had also been established. Consumption figures for this August represent an increase of 16 per cent over the statistics for Aug., 1921.

Production of gasoline during August amounted to 549,958,376 gal. The figures represent a decrease of approximately 20,000,000 gal., or 3.5 per cent from the July output, which set a new monthly record for gasoline manufacture. Stocks of gasoline on hand Sept. 1 amounted to 703,738,310 gal., a decrease of 69,000,000 gal. during the month.

During August the daily average of 1,571,000 bbl. of oil run through the stills of 295 refineries reported to the Bureau of Mines as operating shows a decrease of 1.38 per cent in the amount of oil run and a decrease of 10, or 3.28 per cent, in the number of operating refineries, there is shown a relative increase of 1.96 per cent in the amount of oil run.

Production of gas and fuel oils in August amounted to 944,289,105 gal., which is a slight decrease. Stocks of these oils on Sept. 1 were 1,366,611,311 gal., an increase of about 8,000,000 gal.

Coal Deposit Found

Within five miles of the city of Gillette, Wyo., the Mark Shields Coal Company has unearthed a deposit of coal that is estimated to stand as the third largest find. The vein is ninety-five feet deep and covers an area of 800 acres.

The fields of France and India, while larger, are not as constant in character as the Wyoming find.

Gillette is located on the Kansas City, Lincoln and Billings division of the Chicago, Burlington & Quincy Railroad.

The Atlantic Refining Company declared its regular quarterly dividend of $1.75 on preferred stock, payable Nov. 1 to stock of record Oct. 16.

Kokomo Gas Plant Contract Signed

Kokomo, Ind.—Long negotiations between city officials and the Peoples Gas, Light & Coke Company, of Chicago, parent corporation of the local gas company, for the erection of an artificial gas plant to supply consumers here were ended this week when the City Council voted to approve a contract which contained an amended rate schedule which placed the minimum bill at $1 and the charge for the first 10,000 cu. ft. of gas at $1.25 per thousand. The rate schedule first contained in the contract for the plant called for a 50-cent monthly service charge upon each meter, plus $1.35 per thousand for the first 10,000 cu. ft. Although this rate was informally selected by city officials last March in conference with the gas company officials, it was not until the contract was brought to the council two weeks ago that any objections were raised.

Protest was voiced against the service charge in the first contract. Had not the voices of the women voters of Kokomo been raised loudly against further trifling with the gas supply problem, certain city officials expressed a doubt as to whether or not the contract would have been closed for some time.

Kokomo's mayor, B. C. Moon, and Tex J. Kirkpatrick, local counsel for the gas company, will appear before the Indiana Public Service Commission shortly and present the amended contract between the city and the gas company for its approval.

Continental Gas Surplus

The surplus of the Continental Gas & Electric Corporation for the twelve months ended July 31, after deducting all charges and the payment of dividends on the preferred stock, was $217,489, a gain of 10 per cent over the previous twelvemonth. The company's gross income was $2,463,862, an increase of 9.5 per cent.

Reports to the Government show that in August a new record was made in production of electric energy, that month averaging an output of 131,100,000 kw.-hr. daily, comparing with an average daily output in June of 127,800,000 kw.-hr., the previous daily high record, and a daily average output for the first seven months of 1922 of 123,000,000 kw.-hr.

Gas Companies Preparing for Winter Load

The Gas Machinery Company, of Cleveland, Ohio, has received contracts for benches with Silica retorts and settings to be erected in the gas plants at Waukesha, Wis.; Marinette, Wis., and Danville, Pa.

Bench contracts are also being executed by the same company for the gas plants in Hopkinsville, Ky., and Owensboro, Ky.

Gas companies are all getting their generating equipment in first-class condition for the coming winter and in addition to new benches that are being installed, are also refilling old arches in order to take care of maximum demand.

Voters Grant 35-Year Gas Contract

A thirty-five year exclusive franchise for the establishment of a gas plant at Sault Ste. Marie, Ont., was granted this week to F. W. Freese and T. J. Wilcox. The grant was made in the form of a municipal by-law presented to the voters as a whole for acceptance or rejection, the by-law being accepted by a vote of 827 to 185. Whereas it was necessary for the franchise to receive two-thirds of the votes to carry, it received a majority of more than 81½ per cent of the votes cast.

Vice-President Coolidge to Be Association's Guest

Calvin Coolidge, Vice-President of the United States, will be the principal speaker at the American Gas Association banquet, the culminating event of the association's fourth annual convention, scheduled for Thursday, Oct. 26, at the Traymore Hotel, Atlantic City.

Richmond Wants $1 Gas

Richmond, Va.—A flat gas rate of $1 to all consumers, either domestic or industrial, was the substance of a resolution offered recently in the Common Council by Councilman John Hirschberg. The paper was sent to the ordinance committee.

Directors of the Salt Creek Consolidated Oil Company declared the regular dividend of 25 cents a share, payable Nov. 1 to stockholders of record Oct. 20.

Utility Men Want Public's Good-will

Lake Placid, N. Y.—Declaring that utility companies heretofore had "hidden their light under a bushel," Eugene H. Rosenquest, president of the Empire State Gas and Electric Association, in an address at the annual convention of that organization, said that the industry had turned over a new leaf and was no longer content to remain silent under unjust criticism and misunderstanding.

"We want the good-will of the public, and we know we deserve it," Rosenquest said. "We think we have a right to demand that fair, honest attention be given to us and our good works."

The gas and electric industry of New York State had been included far too often in indiscriminate and misguided criticism, Mr. Rosenquest explained. The companies were condemned as "the interests" and were portrayed as "heartless corporations, squeezing the poor consumer and betraying the public welfare" which they are chartered to serve, it was said.

"If this type of criticism weren't so prevalent," he said, "it would be laughable. There is no concern, no business enterprise operating in this country of ours less open to just attack on this score than the utility company. The capital on which we operate comes from the public—that is, the public owns us, and the Public Service Commission has to approve our capital issues and the spending of the money realized from the sale of our securities.

"Our service is regulated and the rates we may charge are fixed or approved by the Public Service Commission. Our reports are made to the commission; our books and all detai s of our business are open to these public officials. Without gas and electricity modern civilized life as we know it would be unthinkable and it is generally conceded that gas and electricity can be supplied better and cheaper by a State regulated utility company than in any other fashion the mind of mankind has devised.

"Why, then, this criticism? The fault is ours. Modestly, we have not only not bragged about our good works and our public service, but we have even failed to see that the public got adequate information about us. Now we have turned over a new leaf."

Mr. Rosenquest declared that the industry and the public it served had begun to recover from the worst period in a generation and that business is on the upgrade.

While the price of materials and labor are still considerably above the pre-war level and seemed likely to remain so for years, the prices of some materials have receded from the war peak, he said, so that utility companies now can begin to see their way ahead.

Another benefit to the public, he said, was the establishment of a new gas standard for the State.

"The economy of operation under the new standard," said the speaker, "is more than economy for the companies; it is a genuine and considerable economy for the public, not only in the matter of rates, where the consumers have had the benefit passed along to them at once, but also in respect of better gas service. It has been estimated that the saving in the use of oil in manufacturing gas in New York City alone will be sufficient to supply the oil needed for this purpose in all New England."

Public Utilities of U. S. Have 45-Day Supply of Coal

Washington, D. C.—As part of its campaign to stabilize the fuel situation through co-operative effort between the Government and business, the Chamber of Commerce of the United States has made a survey of coal supplies in the States east of the Mississippi and north of the Ohio Rivers. This part of the country has been regarded as the critical territory in the event of a coal shortage this winter. The information gathered by the chamber, which was obtained through local chambers of commerce, may be summarized today as follows:

There are practically no supplies in the hands of local dealers.

Public utilities, about forty-five days.

By-product coke plants fairly well supplied.

General industries, about forty-five days.

The bituminous situation is becoming easier.

There seems to be no general complaint as to price.

The critical situation is that of securing a sufficient domestic supply in advance of cold weather, especially for the Great Lakes States, and the populous areas of New York State, New England and the central Atlantic States.

There is much interest being taken in the use of oil.

There is a general increase in the use of coke for domestic fuel.

Certain cities have very effective systems of gathering information and distributing their coal, while others have nothing.

One of the first steps taken by the chamber in its campaign was to call on industries throughout the country to co-operate by confining purchases of coal to current needs as far as possible.

"The replies received," said the chamber's statement, "show an accord with this request. Many large users of coal have issued instructions to their buyers to limit purchases to reasonable requirements and trade associations as well as commercial organizations have taken special steps to inform their individual members of the chamber's recommendations."

With regard to supplies of coal now in the hands of users, the chamber says:

"A fair approximation of supplies of bituminous coal in the hands of public utilities and general industries would appear to be about forty-five days. This supply, while less than normally carried, appears adequate for current needs. It should be borne in mind, however, that this is an average figure, of small plants and large plants, and covers stock varying from a few days to two or three months and in some instances even longer.

"The variation of supplies in the hands of various industries and in different localities confirms the wisdom of the policy whereby larger consumers are restricting their purchases and enabling those with smaller stocks to acquire supplies proportionate to their needs."

Pressure Pipe Up $3 a Ton in Alabama

Birmingham, Ala.—Responding to the higher base in the pig iron market, pressure pipe has been marked up $3 a ton in the Birmingham district. This is the new schedule of the United States Pipe & Foundry Company, whose lead is usually followed by other makers. The new base is $43 for six-inch sizes and larger. Local pressure pipe plants report all the business they can do.